STUDY PLAN FOR WATERFOWL INJURY ASSESSMENT: DETERMINING PCB CONCENTRATIONS IN HUDSON RIVER RESIDENT WATERFOWL

HUDSON RIVER NATURAL RESOURCE DAMAGE ASSESSMENT

HUDSON RIVER NATURAL RESOURCE TRUSTEES

STATE OF NEW YORK

U.S. DEPARTMENT OF COMMERCE

U.S. DEPARTMENT OF THE INTERIOR

PUBLIC RELEASE VERSION*

FINAL

DECEMBER 2008

Available from:
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
Hudson River NRDA, Lead Administrative Trustee
Assessment and Restoration Division, N/ORR3
1305 East-West Highway, Rm 10219
Silver Spring, MD 20910-3281

**Names of certain individuals and affiliations have been removed to maintain confidentiality*

Table of Contents

EXECUTIVE SUMMARY

Past and continuing discharges of polychlorinated biphenyls (PCBs) have contaminated the natural resources of the Hudson River. The Hudson River Natural Resource Trustees (Trustees) - New York State, the U.S. Department of Commerce, and the U.S. Department of the Interior - are conducting a natural resource damage assessment (NRDA) to assess and restore those natural resources injured by PCBs.

In 2008, the Trustees propose to investigate PCB contaminant levels in Hudson River waterfowl in order to determine whether PCB concentrations found in edible portions of resident ducks exceed tolerance levels established by the U.S. Food and Drug Administration (USFDA) (43 CFR 11.62(f)(1)(ii)). The USFDA tolerance for PCBs in poultry is 3.0 parts per million (ppm or µg/g) on a fat basis (21 CFR 109.30(a)(3)). Poultry has been defined as including, among others, chickens, turkeys, geese, and ducks (9 CFR 381.1). The USFDA tolerance for PCBs in eggs is 0.3 ppm (21 CFR 109.30(a)(4)).

Previous studies in other waters of New York State have demonstrated that waterfowl can rapidly accumulate PCBs in their tissues, but the migratory nature of waterfowl makes it difficult to determine the relative contribution of PCBs from varying sources. To avoid this problem, the Trustees will collect waterfowl resident to the Hudson River. The term "resident" in the context of this study, describes waterfowl that have bred, nested, or hatched on the Hudson River. Mallards (*Anas platyrhynchos*) are the most common duck on the Hudson River and will be the primary target of this study.

The study objectives are: 1) determine the concentrations of PCBs in waterfowl resident to the Hudson River; 2) determine proportions of waterfowl and waterfowl eggs having PCB concentrations that exceed the existing USFDA tolerance for those residues in poultry; and 3) determine the PCB contribution by adult mallards to juvenile mallards via PCB transfer in eggs based upon the calculation of PCB mass.

Waterfowl will be collected from four study areas:

- Area 1 - A reference area upstream of South Glens Falls in the upper river between the Feeder Canal Dam and International Paper Company in Corinth;
- Area 2 - Fort Edward to Northumberland in the upper river;
- Area 3 - Schuylerville to Mechanicville in the upper river; and
- Area 4 - New Baltimore to Newburgh in the lower river.

In spring 2008, the Trustees will collect 10 mallard eggs from each of four study areas for PCB analysis. Both juvenile and adult mallards will be sampled during late July to mid August 2008 prior to achievement of flight (adults are flightless due to replacement of flight feathers) and initiation of migration. Sampling during this time will ensure that waterfowl sampled did not migrate in from other water bodies and are truly resident to the Hudson River. A target of 30 juvenile and 30 adult birds are to be taken from each sampling area for PCB analysis. In addition, up to 20 "targets of opportunity" may be taken from the entire upper reach of the river between Fort Edward and Mechanicville, and 20 from the lower river between New Baltimore and Newburgh. "Targets of opportunity" may include wood ducks (*Aix sponsa*), common mergansers (*Mergus merganser*), and black ducks (*Anas rubripes*), as available.

Two types of tissues from juvenile and adult birds are to be analyzed: breast muscle and dissectable subcutaneous fat. Samples will be analyzed for total PCBs, PCB homologs, 48 select congeners, moisture, and lipid content. Mallard eggs will be analyzed for the same suite of analytes.

This study represents a more detailed assessment of PCB concentrations in resident waterfowl taken from the Hudson River than those conducted previously. The results of this study will produce a current and comprehensive data set for PCB concentrations in eggs and edible tissues of resident mallards, and other available waterfowl, from the Hudson River, and determine the proportions of resident waterfowl that exceed the USFDA tolerance of 3.0 ppm (fat basis) for PCBs in poultry and 0.3 ppm in eggs.

1.0 BACKGROUND

The Hudson River Natural Resource Trustees, comprised of the U.S. Department of Interior; the U.S. Department of Commerce, represented by the National Oceanic and Atmospheric Administration (NOAA); and the State of New York, represented by the New York State Department of Environmental Conservation (NYSDEC), are conducting a natural resource damage assessment (NRDA) for the Hudson River. As part of this process, the Trustees propose to investigate PCB contaminant levels in Hudson River resident waterfowl in order to determine whether certain Hudson River waterfowl have been injured by PCBs. Potential injuries to waterfowl from PCBs include the presence of PCB concentrations in edible portions of the waterfowl that exceed tolerance levels established by the U.S. Food and Drug Administration (USFDA) (43 CFR 11.62(f)(1)(ii)).

The USFDA tolerance for PCBs in poultry is 3.0 parts per million (ppm or μg/g) on a fat basis (21 CFR 109.30(a)(3)). Poultry has been defined as including, among others, chickens, turkeys, ducks, and geese (9 CFR 381.1). The USFDA tolerance for PCBs in eggs is 0.3 ppm (21 CFR 109.30(a)(4)).

Waterfowl are migratory birds and within New York most birds tend to use one of several corridors, including the Hudson-Champlain corridor. In the Hudson River basin, birds arrive from spring migrations in late March and early April. In general, nesting and brooding of eggs occurs by mid to late April, and young are hatched in mid May. The term "resident" in the context of this study, describes waterfowl that have bred, nested, or hatched on the Hudson River.

At hatch, waterfowl are flightless, and juveniles remain flightless until about mid July when flight feathers are obtained. The Upper Hudson River is segmented into "pools" by the existence of a number of dams. Based on observation, the birds within each pool tend to remain within that pool throughout their period of residency on the river. As a consequence, essentially all chemical exposures are local. The only exception may be the residues that have been transferred to the young by the adult female via the egg. In early summer, following the breeding period, the adults undergo molting of their flight feathers and are flightless for a period of about two months (Drilling *et al.*, 2002). During this period, the resident adults also rely solely on food sources within the river and maintain a close association with their young to support their continued growth.

Waterfowl can rapidly accumulate PCBs in their tissues (Foley and Batcheller 1988, Skinner 1992, Swift *et al.* 1993). The Hudson River may contribute significantly to the chemical residue load in waterfowl during their approximately five months of residency on the river, between arrival in the spring and fall migration. Once fall migration commences, waterfowl from other areas co-mingle with resident Hudson River birds. At this time Hudson River and migratory waterfowl of the same species cannot be readily distinguished from each other.

Several previous studies have measured PCB concentrations in waterfowl taken from the Hudson River (Baker *et al.* 1976, Foley 1992, Kim *et al.* 1985, Kim *et al.* 1984, O'Keefe *et al.* 2006). In most of these studies, sample collection occurred within the hunting season during fall migrations, and the birds taken could not be determined to be residents of the river. In addition, most of the data available for Hudson River waterfowl are significantly dated. Over twenty years have passed since any significant amount of chemical residue data in waterfowl has been generated that would be useful for assessing temporal changes in chemical residues in such birds.

The Trustees now plan to collect resident waterfowl to provide an updated database of PCB concentrations in Hudson River waterfowl and to compare those PCB concentrations to USFDA poultry tolerance values.

2.0 INTRODUCTION

This Final Work Plan is for the collection of resident waterfowl from the Hudson River for PCB analysis during 2008. The primary aim of this study is to determine if PCB concentrations in resident Hudson River waterfowl exceed the USFDA tolerance for PCBs in poultry and eggs. For resident juvenile waterfowl, the data will assist in calculating the concentrations of PCBs that are accumulated by waterfowl from a PCB contaminated river source. Similarly, for adult resident waterfowl, there will be an indication of the contributions of the river to the total PCB concentrations within the birds.

3.0 PURPOSE AND OBJECTIVES

Three objectives are proposed for this project: 1) determine the concentrations of PCBs in waterfowl resident to the Hudson River; 2) determine proportions of waterfowl and waterfowl eggs having PCB concentrations that exceed the existing USFDA tolerance for those residues in poultry; and 3) determine the PCB contribution by adult mallards to juvenile mallards via PCB transfer in eggs based upon the calculation of PCB mass.

All data generated for waterfowl will be the basis for determining whether the presence of PCBs from the Hudson River environment has resulted in a natural resource injury to waterfowl as defined by the U.S. Department of the Interior Natural Resource Damage Assessment regulations at 43 CFR Part 11.

4.0 METHODS

The attached work plan entitled, "Determining PCBs in Hudson River Resident Waterfowl: 2007-2008 Field Seasons" (Appendix A) describes the waterfowl investigation that the Trustees will implement to evaluate whether waterfowl in the vicinity of the Hudson River are injured due to exposure to PCBs. The attached work plan includes information regarding the experimental design, Quality Assurance/Quality Control, and Standard Operating Procedures that will be used in the study. Section 4.1 and 4.2 summarize the work described in Appendix A.

4.1 PCB CONCENTRATIONS IN RESIDENT WATERFOWL

Two species of waterfowl are commonly present on or along the Hudson River for the purpose of reproduction: mallards and wood duck. However, their numbers at any particular location are often small. Therefore, a fairly large expanse of river may need to be sampled to obtain the numbers of waterfowl targeted for this study.

Mallards are the most numerous duck on the Hudson River and are representative of other waterfowl species with similar feeding preferences (e.g., wood ducks). Sampling is to be directed separately to eggs, young-of-year (hatch year or juvenile), and to adult mallards from four general areas of the river as follows:

Area 1 - A reference area upstream of South Glens Falls in the upper river between the Feeder Canal Dam and International Paper Company in Corinth;

Area 2 - Fort Edward to Northumberland in the upper river;

Area 3 - Schuylerville to Mechanicville in the upper river; and

Area 4 - New Baltimore to Newburgh in the lower river.

Collections from each area are to be distributed along the length of the area in a random fashion with the intent to represent the entire area defined, and without concentrating the collection of birds within any portion of the area to the extent possible or practicable. Collections of birds in areas associated with concentrated human habitation or with wastewater outfalls are to be avoided where possible in order to minimize the potential for confounding inputs.

4.1.1 EGG COLLECTIONS

A total of 10 mallard eggs per sampling area (4 areas, 40 samples total) will be taken in spring 2008. The intent of collection of waterfowl eggs is to demonstrate contributions of PCBs to juvenile mallards by the adult female through PCB deposition in the egg. One egg will be collected from each nest. Nests will be located within 0.5 miles of the Hudson River. Due to the secretive nature of nesting, the ability of sampling personnel to determine the location of mallard nests will be a major challenge to the collection of eggs and could influence final sample size. Mallard nests will be located using nesting structures, aerial imagery, field surveys, and public outreach.

PCB levels in eggs will be compared to the 0.3 ppm USFDA tolerance level for PCBs in eggs. Egg collection, sample handling, and processing procedures are described in greater detail in Appendix A.

4.1.2 JUVENILE AND ADULT COLLECTIONS

During late July through mid-August 2008, 30 juvenile and 30 adult mallards will be collected from each sampling area. For adult birds, the study will target an equal sex representation (i.e., 15 males and 15 females, per area). If 30 samples cannot be collected, a minimum of 20 birds per age and area (maintaining a 1:1 sex ratio for adults) may provide an estimate of PCB variability in mallards. Samples will be collected on the river or in wetlands adjacent to the river but at distances no further than 0.25 mile from the river's shoreline. Specimens may be taken by shooting, trapping, or netting when they occur within the specified areas.

In addition, targets of opportunity, in particular, waterfowl species other than mallards (e.g., wood ducks, mergansers, black ducks, etc.) that are in their hatch year will be collected to provide an assessment of the use of mallards as surrogates, and to expand the scope of a waterfowl injury determination. Up to 20 of these specimens may be taken from the entire upper reach of the river between Fort Edward and Mechanicville, and, similarly, 20 specimens from the lower river between New Baltimore and Newburgh.

PCB levels in juvenile and adult tissues will be compared to the 3.0 ppm USFDA poultry tolerance. Adult and juvenile collections and sample handling and processing procedures are described in greater detail in Appendix A.

4.3 CHEMICAL ANALYSIS

Chemical analyses for egg content, breast muscle, and subcutaneous fat samples will include total PCBs, PCB homologs, select PCB congeners, moisture and lipid content. Any analytical chemistry data will be validated as specified in the Analytical Quality Assurance Plan (Hudson River Natural Resource Trustees 2005). Chemical analyses are described in greater detail in Appendix A.

4.4 STATISTICAL ANALYSIS

Statistical assessments are necessary to determine if there is a natural resource injury resulting from the presence of PCB in waterfowl and to quantify the extent of that injury. Sample sizes were selected to 1) obtain a statistically valid and robust representation of PCB concentrations in waterfowl, 2) assess the relative variability of PCB concentrations in resident waterfowl, and 3) establish whether the USFDA tolerance for PCBs in poultry has been exceeded by any of the samples examined. Statistical analyses are described in greater detail in Appendix A.

5.0 QUALITY ASSURANCE/QUALITY CONTROL

This study is being conducted in accordance with the Analytical Quality Assurance Plan for the Hudson River NRDA (Hudson River Natural Resources Trustees 2005).

Strict chain-of-custody procedures will be used throughout the study. All samples collected under this Study Plan will be maintained under chain-of-custody upon collection, and through processing, storage and shipment to the testing laboratory, analytical laboratory or archive facility.

Analysis will be by appropriate methods approved by the Trustees. As noted above, chemical analytes may include congener-specific PCBs. In order to minimize analytical costs, and reduce the overall cost associated with the project, the Trustees may conduct the chemical or other analyses in stages, using initial work to inform subsequent decisions regarding which analyses to conduct on which samples.

The laboratories performing analytical work will be contracted to follow the Trustees' Analytical Quality Assurance Plan for the Hudson River NRDA (Hudson River Natural Resource Trustees 2005). Laboratories will provide fully documented data packages which will enable data validation to be performed based on the criteria provided in the Analytical Quality Assurance Plan for the Hudson River NRDA, applicable laboratory Standard Operating Procedures, and relevant U.S. Environmental Protection Agency guidelines (USEPA 1999).

Quality assurance and quality control are described in greater detail in Appendix A.

6.0 SPECIAL PROVISIONS

All collection of eggs and any waterfowl will be conducted under permits from USFWS and appropriate New York State agencies.

7.0 LITERATURE CITED

Baker, F., C. Tumasonis, W. Stone, and B. Bush. 1976. Levels of PCB and trace metals in waterfowl in New York State. NY Fish Game J. 23:82-91.

Drilling, N., R. Titman, and F. McKinney. 2002. Mallard (*Anas platyrhynchos*). *In*: The Birds of North America, No. 658. (A. Poole and F. Gill, *eds*.) The Birds of North America, Inc., Philadelphia, PA.

Foley, R. E. 1992. Organochlorine residues in New York waterfowl harvested by hunters in 1983-1984. Environmental Monitoring and Assessment 21:37-48.

Foley. R. E., and G. R. Batcheller. 1988. Organochlorine contaminants in common goldeneye wintering on the Niagara River. Journal of Wildlife Management 52:441-445.

Hudson River Natural Resource Trustees. 2005. Analytical Quality Assurance Plan: Hudson River Natural Resource Damage Assessment, Version 2.0. 31 p.

Kim, H. T., K. S. Kim, J. S. Kim, and W. B. Stone. 1985. Levels of polychlorinated biphenyls (PCBs), DDE, and mirex in waterfowl collected in New York State, 1981-1982. Archives of Environmental Contamination and Toxicology 14:13-18.

Kim, K. S., M. J. Pastel, J. S. Kim, and W. B. Stone. 1984. Levels of polychlorinated biphenyls, DDE, and mirex in waterfowl collected in New York State, 1979-1980. Archives of Environmental Contamination and Toxicology 13:373-381.

O'Keefe, P. W., W. C. Clayton, S. Connor, B. Bush, and C.-S. Hong. 2006. Organic pollutants in wild ducks from New York State: I. Interspecies differences in concentrations and congener profiles of PCBs and PCDD/PCDFs. Science of the Total Environment 361:111-123.

Skinner, L. C. 1992. Chemical contaminants in wildlife from Akwesasne and the vicinity of the General Motors Corporation/Central Foundry Division Massena, New York plant. Tech. Rep. 92-4 (BEP). Division of Fish and Wildlife, New York State Department of Environmental Conservation, Albany, NY. 113 p.

Swift, B. L., R. E. Foley, and G. R. Batcheller. 1993. Organochlorines in common goldeneyes wintering in New York. Wildlife Society Bulletin 21:52-56.

U.S. Environmental Protection Agency. 1999. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. Office of Emergency and Remedial Response, Washington, D.C. 20460.EPA540/R-99/008. 118 pp.

Appendix A

Quality Assurance Project Plan and General Workplan

Determining PCBs in Hudson River Resident Waterfowl: 2007-2008 Field Seasons

HUDSON RIVER NATURAL RESOURCE TRUSTEES

Quality Assurance Project Plan and General Work Plan

Determining PCBs in Hudson River Resident Waterfowl:

2007-2008 Field Seasons

Principal Investigator: _____
Sean Madden, NYS Department of Environmental Conservation

Hudson River Quality
Assurance Coordinator: _____

Date: November 29, 2006
Revised: March 28, 2007
May 16, 2007
July 2, 2007
Jan 11, 2008
April 22, 2008
May 28, 2008
June 30, 2008

Investigation Team Acknowledgement Of Work Plan Review And Compliance

By my signature, I acknowledge that I have read this Work Plan and understand it, and will comply with it in performing this work.

Name (printed): _____ Name (printed): _____

Signature: _____ Signature: _____

Date: _____ Date: _____

Title: _____ Title: _____

Name (printed): _____ Name (printed): _____

Signature: _____ Signature: _____

Date: _____ Date: _____

Title: _____ Title: _____

Name (printed): _____ Name (printed): _____

Signature: _____ Signature: _____

Date: _____ Date: _____

Title: _____ Title: _____

Name (printed): _____ Name (printed): _____

Signature: _____ Signature: _____

Date: _____ Date: _____

Title: _____ Title: _____

Name (printed): _____ Name (printed): _____

Signature: _____ Signature: _____

Date: _____ Date: _____

Title: _____ Title: _____

EXECUTIVE SUMMARY

Past and continuing discharges of polychlorinated biphenyls (PCBs) have contaminated the natural resources of the Hudson River. The Hudson River Natural Resource Trustees (Trustees) - New York State, the U.S. Department of Commerce, and the U.S. Department of the Interior - are conducting a natural resource damage assessment (NRDA) to assess and restore those natural resources injured by PCBs.

In 2008, the Trustees propose to investigate PCB contaminant levels in Hudson River waterfowl in order to determine whether PCB concentrations found in edible portions of resident ducks exceed tolerance levels established by the U. S. Food and Drug Administration (USFDA) (43 CFR 11.62(f)(1)(ii)). The USFDA tolerance for PCBs in poultry is 3.0 parts per million (ppm or µg/g) on a fat basis (21 CFR 109.30(a)(3)). Poultry has been defined as including, among others, chickens, turkeys, geese, and ducks (9 CFR 381.1). The USFDA tolerance for PCBs in eggs is 0.3 ppm (21 CFR 109.30(a)(4)).

Previous studies in other waters of New York State have demonstrated that waterfowl can rapidly accumulate PCBs in their tissues, but the migratory nature of waterfowl makes it difficult to determine the relative contribution of PCBs from varying sources. To avoid this problem, the Trustees will collect waterfowl resident to the Hudson River. The term “resident” in the context of this study, describes waterfowl that have bred, nested, or hatched on the Hudson River. Mallards (*Anas platyrhynchos*) are the most common duck on the Hudson River and will be the primary target of this study.

The study objectives are: 1) determine the concentrations of PCBs in waterfowl resident to the Hudson River; 2) determine proportions of waterfowl and waterfowl eggs having PCB concentrations that exceed the existing USFDA tolerance for those residues in poultry; and 3) determine the PCB contribution by adult mallards to juvenile mallards via PCB transfer in eggs based upon the calculation of PCB mass.

Waterfowl will be collected from four study areas:

- Area 1 - A reference area upstream of South Glens Falls in the upper river between the Feeder Canal Dam and International Paper Company in Corinth
- Area 2 - Fort Edward to Northumberland in the upper river
- Area 3 - Schuylerville to Mechanicville in the upper river
- Area 4 - New Baltimore to Newburgh in the lower river

In spring 2008, the Trustees will collect 10 mallard eggs from each of four study areas for PCB analysis. Both juvenile and adult mallards will be sampled during late July to mid August 2008 prior to achievement of flight (adults are flightless due to replacement of flight feathers) and

initiation of migration. Sampling during this time will ensure that waterfowl sampled did not migrate in from other water bodies and are truly resident to the Hudson River. A target of 30 juvenile and 30 adult birds are to be taken from each sampling area for PCB analysis. In addition, up to 20 “targets of opportunity” may be taken from the entire upper reach of the river between Fort Edward and Mechanicville, and 20 from the lower river between New Baltimore and Newburgh. “Targets of opportunity” may include wood ducks (*Aix sponsa*), common mergansers (*Mergus merganser*), and black ducks (*Anas rubripes*), as available.

Two types of tissues from juvenile and adult birds are to be analyzed, breast muscle and dissectable subcutaneous fat. Samples will be analyzed for total PCBs, PCB homologs, 48 select congeners, moisture, and lipid content. Mallard eggs will be analyzed for the same suite of analytes.

This study represents a more detailed assessment of PCB concentrations in resident waterfowl taken from the Hudson River than those conducted previously. The results of this study will produce a current and comprehensive data set for PCB concentrations in eggs and edible tissues of resident mallards, and other available waterfowl, from the Hudson River, and determine the proportions of resident waterfowl that exceed the USFDA tolerance of 3.0 ppm (fat basis) for PCBs in poultry and 0.3 ppm in eggs.

Table of Contents

1. Project Name: Determining PCBs in Hudson River Resident Waterfowl: 2007-2008 Field Seasons

2. Principal Investigator: Sean Madden, NYS Department of Environmental Conservation

3. Hudson River Quality Assurance Coordinator

4. Date Project Proposed: November 30, 2006

5. Date of Project Initiation: Spring 2008

6. Project requested by: Hudson River Natural Resource Trustee Council

7. Project Description:

A. Background

The Hudson River Natural Resource Trustee Council, comprised of the U. S. Department of Interior; the U. S. Department of Commerce, represented by the National Oceanic and Atmospheric Administration (NOAA); and the State of New York, represented by the New York State Department of Environmental Conservation (NYSDEC), is conducting a natural resource damage assessment (NRDA) for the Hudson River. As part of this process, the Trustees propose to investigate PCB contaminant levels in Hudson River resident waterfowl in order to determine whether certain Hudson River waterfowl have been injured by PCBs found in the environment. Potential injuries to waterfowl from PCBs include the presence of PCB concentrations in edible portions of the waterfowl that exceed tolerance levels established by the U. S. Food and Drug Administration (USFDA) (43 CFR 11.62(f)(1)(ii)).

The USFDA tolerance for PCBs in poultry is 3.0 parts per million (ppm or µg/g) on a fat basis (21 CFR 109.30(a)(3)). Poultry has been defined as including, among others, chickens, turkeys, ducks and geese (9 CFR 381.1). The USFDA tolerance for PCBs in eggs is 0.3 ppm (21 CFR 109.30(a)(4)).

Table 1 provides a summary of PCB concentrations in waterfowl taken from the Hudson River over time. These data are the principal basis used for development of consumption advisories by NYSDOH. In five of the six studies cited, collection of samples occurred within the hunting season during fall migrations; whether some of the birds taken could have been residents of the river could not be determined. Therefore, while the birds are known to have had at least some exposure to PCBs derived from the Hudson River, there is some difficulty in determining the relative amount of such exposures from Hudson River sources. Only Secord (reference 6 of Table 1) provided PCB data for resident mallards and wood ducks from the Hudson River, and the number of such samples was very limited. The data for whole birds when converted to lipid based concentrations ranged from 8.5 to 98 µg/g. The data for egg samples, measured in wet weight, ranged from 1.14 to 98.0 µg/g. The corresponding PCB tolerance for poultry is 3.0 ppm (lipid

basis) and for eggs is 0.3 ppm (wet weight basis) (21 CFR 109.30(a)(4)). All of the whole bird levels exceed the USFDA tolerances for PCB in poultry, and 2 out of 4 egg levels exceed the USFDA tolerances for PCB in eggs.

Other issues are found in Table 1 and are expounded upon hereafter.

1) Waterfowl analyzed in the Foley (1992) study were taken within the Hudson - Champlain corridor, thus, some birds may have been taken from Lake Champlain. It can be presumed that most of the birds within this flyway taken from Lake Champlain may have been exposed to the Hudson, but based on the information collected, the relative contribution of the sources (the Hudson, Lake Champlain, or other sources within the migratory route) of the PCBs and other chemical residues reported for these samples cannot be determined with certainty.

2) Most of the data available for Hudson River waterfowl are significantly dated. Three of the seven data sets, the most extensive data available, are from the period 1979 through 1984. Another set consisting of five birds were taken prior to 1976. The most recent information is the limited resident bird (mallards and wood ducks) data collected in 1995 and 1998, and the four mallards collected during the 2000 hunting season in the upper Hudson. Therefore, over twenty years have passed since any significant amount of chemical residue data in waterfowl has been generated that would be useful for assessing temporal changes in chemical residues in such birds.

Chemical residues in addition to PCBs have been detected in wild waterfowl from New York State. Foley (1992) reported concentrations of total DDT, dieldrin, total chlordane analytes, and HCB (Table 2). O'Keefe *et al*. (1984) documented concentrations of tetrachlorodibenzo-*p*-dioxins and tetrachlorodibenzofurans in three waterfowl samples (Table 3). In the latter study, 2,3,7,8-TCDD concentrations were reported as non-detectable but the detection limits (26 to 88 pg/g) were elevated above desired values (1.0 pg/g or less). Baker *et al*. (1976) analyzed cadmium, lead, beryllium, arsenic and mercury in several birds from the Hudson but the metals were seldom detected. At the time of analysis, the available analytical methods generally did not permit low detection limits (except for mercury), thus, the low detection rate for the five metals.

PCBs and organochlorine pesticides can be rapidly accumulated in the tissues of waterfowl. For example, common goldeneye wintering on the Niagara River showed a doubling of PCB and DDE residues in three to four months of exposure on the river (Foley and Batcheller, 1988). Swift *et al*. (1993) found in their follow-up studies in 1988 that concentrations of these analytes had declined by 50 percent or more from the original sampling by Foley and Batcheller (1988) in 1984. In another example, several flightless hatch year waterfowl (mallard, gadwall, common merganser) taken from the vicinity of aluminum manufacturing facilities in Massena, NY accumulated PCB within their first four months of life to levels that were as much as two orders of magnitude greater than the USFDA tolerance (Skinner, 1992).

B. Study objectives

Three objectives are proposed for this project:

1) determine the concentrations of PCBs in waterfowl resident to the Hudson River;

2) determine proportions of waterfowl and waterfowl eggs having PCB concentrations that exceed the existing USFDA tolerance for those residues in poultry; and

3) determine the PCB contribution by adult mallards to juvenile mallards via PCB transfer in eggs based upon the calculation of PCB mass.

C. Data usage

For resident juvenile waterfowl, the data will assist in calculating the concentrations of PCBs that are accumulated by waterfowl from a PCB contaminated river source. Similarly, for adult resident waterfowl, there will be an indication of the contributions of the river to the total PCB concentrations within the birds.

All data generated for waterfowl will be the basis for determining whether the presence of PCBs from the Hudson River environment has resulted in a natural resource injury to waterfowl as defined by the U.S. Department of the Interior Natural Resource Damage Assessment regulations at 43 CFR Part 11.

D. Sampling design and rationale

1. General waterfowl life history

Waterfowl are migratory birds which, in North America, migrate from southern overwintering areas to northern breeding and rearing areas in spring, and return to the southern areas in fall. Migrations occur along four major flyways, i.e., Atlantic, Central, Mississippi and Pacific. New York is in the Atlantic flyway. Within New York, birds may migrate within any area throughout the state but most birds tend to use one of several corridors, including the Hudson-Champlain corridor. In the Hudson River basin, birds arrive from spring migrations in late March and early April. Nesting and brooding of eggs occurs by mid to late April and young are hatched in mid May. Location on the river affects the timing of these activities, with somewhat earlier arrival and nesting occurring in the southern portion of the river. Inclement weather (e.g., unusually cold temperatures, high water) may delay nesting and egg-laying by as much as seven to ten days. Favorable weather may somewhat advance nesting. Adult exposures to the river prior to egg laying is believed to be only about two to three weeks, but this period is important to restore energy reserves lost during migration and in preparation for nesting and egg-laying.

Waterfowl, at hatch, are flightless until about mid July when flight feathers are obtained. However, the birds maintain their residency while further growth is attained. The Upper Hudson River is segmented into “pools” by the existence of a number of dams, and based on the observations of NYSDEC waterfowl biologists the birds within each pool tend to remain within the pool throughout their period of residency on the river. Therefore, all food sources for the juveniles are confined to these pools (or nearby environs) during this period of time. As a consequence, essentially all chemical exposures are local. The only exception may be the residues that have been transferred to the young by the adult female via the egg, although a portion of the PCB residues in the egg may also be from the Hudson River from accumulation during the period of feeding on or along the river prior to egg-laying.

In early summer, following the breeding period, the adults undergo molting of their flight feathers and are flightless for a period of about two months (Drilling *et al*., 2002). The Hudson River is not known to contain areas where birds in molt will congregate. This is due to the lack of large wetland areas necessary to provide protection of the larger numbers of birds. Therefore, the adult birds present are the birds that will temporarily reside on or along the river during nesting and the rearing of young. During this period, the adults also rely solely on food sources within the river or its environs. Further, they maintain a close association with their young during their period of growth. As noted in section 7.A., adult waterfowl can rapidly accumulate certain chemical residues, including PCBs, from local sources. The Hudson River may contribute significantly to the chemical residue load in waterfowl during their approximately five months of residency on the river, between spring migration arrival and fall migration. Due to their migratory behavior, adult exposures can be more broadly based and consist of the local Hudson River exposures as well as any exposures occurring at overwintering areas or at intermediate areas during spring and fall migrations.

Once fall migrations commence, waterfowl from other areas co-mingle with resident Hudson River birds. At this time Hudson River and migratory waterfowl of the same species cannot be readily distinguished from each other.

2. Sample design

Two species of waterfowl are commonly present on or along the Hudson River for the purpose of reproduction, mallards and wood duck. However, their numbers at any particular location are often small. Therefore, a fairly large expanse of river may need to be sampled to obtain the numbers of samples requested for the purposes of this study. Sampling will be directed at eggs in the spring and both juvenile and adult birds during late July to mid August (adults are flightless due to replacement of flight feathers) prior to achievement of flight and initiation of migration. Since there is only a very limited data set for resident birds taken from the Hudson River, there is very little basis for statistically determining potential sample sizes for PCB determinations. Therefore, the sample sizes suggested hereafter for resident waterfowl are for 1) obtaining a statistically valid and robust representation of PCB concentrations in waterfowl, 2) assessing the

relative variability of PCB concentrations in resident waterfowl, and 3) establishing whether the USFDA tolerance for PCBs in poultry has been exceeded by any of the samples examined.

Mallards are the majority of the birds on the Hudson River and are representative of other waterfowl species with a similar feeding preferences, e.g., wood ducks. Sampling is to be directed separately to eggs, young-of-year (hatch year or juvenile) birds and to adults from four general areas of the river as follows (also see Figure 1):

Area 1	A reference area upstream of South Glens Falls in the upper river between the Feeder Canal Dam and International Paper Company in Corinth
Area 2	Fort Edward to Northumberland in the upper river
Area 3	Schuylerville to Mechanicville in the upper river
Area 4	New Baltimore to Newburgh in the lower river

Collections from each area are to be distributed along the length of the area in a random fashion with the intent to represent the entire area defined, and without concentrating collection of birds within any portion of the area to the extent possible or practicable. Collections of birds in areas associated with concentrated human habitation or with wastewater outfalls are to be avoided in order to minimize the potential for confounding inputs.

Summer 2007 - Preliminary field work

The 2007 field season was designed to provide field personnel some familiarity with the study areas and help anticipate logistical obstacles before the formal study begins in 2008. The preliminary field work was divided into two categories: reconnaissance and trial collection methods.

Reconnaissance - During late July and early August 2007, NYSDEC personnel performed field reconnaissance of the four study areas. A reconnaissance consisted of scanning the river, shoreline, tributaries, and wetlands using binoculars. The duration of reconnaissance varied depending on the length of the study area being surveyed, but generally consisted of several hours, observing from a boat or on foot. A crew of 2 or more moved from upstream to downstream scanning both shorelines until the extent of the study area or other barrier (e.g. a canal lock) was reached. The crew then headed back upstream continuing to scan both shorelines. As depth and conditions allowed the crew investigated backwaters, wetlands, and tributaries. During the reconnaissance, the crew noted the location and numbers of any ducks observed, habitats where ducks were likely to be encountered, potential water and land access points to the Hudson River and its associated wetlands and tributaries, and land owner information for access if it may be required during the study.

Mallards were observed in all study areas except Study Area 1, and the probability of collecting statistically robust sample size seems high. Even in Study Area 1, the number of wetlands, tributaries, and backwater areas suggests that mallards are likely to be present in sufficient numbers for the 2008 collections.

Trial Collection Methods - Although shooting is the proposed field collection method for the 2008 collection of adult and juvenile mallards, on days when regional wildlife staff is not available or where conditions or land owner permission limits shooting, employing other collection methods may be necessary. During late July and early August 2007, NYSDEC personnel used baited swim-in traps, baited walk-in traps, and nighttime spotlighting and netting to test their effectiveness at catching ducks. Any ducks captured were aged, sexed, and released.

Baited swim-in traps were constructed from a design modified from Harrison et al. (2000) and placed in Area 1 and Area 2 after being set and baited with cracked corn. After several days of effort, no ducks were caught. Although traps of this kind have been used effectively in other waterfowl studies, the necessity for pre-baiting is not well-suited for this study. Pre-baiting would introduce a foreign and presumably clean food source to Hudson River ducks. In addition, the large size of the traps makes them difficult for a small field crew to transport and deploy. Baited swim-in traps will not be used during the Summer 2008 collections.

In contrast, baited walk-in traps were small, compact and easy to transport. The traps were 3 ft x 3 ft with a central bait pan. When the trap was set, pressure on the bait pan released a spring-loaded arm that sweeps a nylon mesh net over the top of the trap. Again, cracked corn was used as bait. In Area 2, seven ducks were caught in only 2 nights of effort. Since the traps lie flat when set, ducks seemed less wary to approach the bait and the traps required no baiting in advance. This type of trap could serve as a reasonable supplement to the 2008 waterfowl collection on days or in areas where shooting is impractical.

Several articles from the wildlife management literature in the 1960s describe the common poaching technique of spotlighting and netting ducks while flightless as an effective method for capturing ducks for banding (e.g., Bishop and Barratt 1969 and Lindmeier and Jessen 1961). The spotlight tends to stun or confuse the ducks allowing for easy approach in a boat. When close enough, the duck or ducks are captured with a long-handled dip net. This method was attempted in Area 2 and Area 3. A crew of three (one driver, one spotlighter, and one netter) proved safest and most efficient. In Area 2, two ducks were caught in 2 hours of effort. In Area 3, no ducks were observed. This method could prove to be a reasonable supplement to 2008 waterfowl collections in areas where shooting may not be feasible. Using brighter spotlights (10 million candle power) and longer-handled dipnets (> 5 ft) would increase capture success.

Spring 2008 - Egg collections

The intent of collection of waterfowl eggs is to demonstrate contributions of PCBs to juvenile mallards by the adult female through PCB deposition in the egg. A total of ten (10) mallard eggs per sampling area (4 areas, 40 samples total) will be taken in Spring 2008. One egg will be collected from each nest. When a mallard nest is located, the number of eggs present will be noted. If the clutch size is 8 or more and the eggs are warm, an egg will be randomly collected. If the clutch size is less than eight, a representative of the field crew will return after 2-5 days to see if any more eggs have been laid. If no more eggs have been laid and the eggs are warm, an egg will be randomly collected. If more eggs have been laid and the eggs are not warm, the field crew will return to the nest every 1-2 days until the clutch is determined to be complete, at which point an egg will be randomly collected. Eggs collected should be distributed over the distance of the sample area to the extent practical. Sample handling shall be in accordance with Appendix A, Standard Sample Handling for Waterfowl.

Due to the secretive nature of nesting, the ability of sampling personnel to determine the location of mallard nests will be a major challenge to the collection of eggs and could influence final sample size. In the prairie pothole region of North America, over-water nest structures have been successfully used to promote mallard breeding (Chouinard et al. 2005, Eskowich et al. 1998, Johnson et al. 1994) To facilitate the egg collection for this study, twenty (20) over-water mallard nest structures will be spatially distributed in each of the Upper Hudson River study areas (Areas 1, 2, and 3). The nest structures are a molded plastic cylinder with hay nesting material mounted on a pole driven into the sediment (**www.dakotanesting.com**). The structures are designed to sit 3-5 feet over the water and several feet from the shoreline to limit clutch loss from predation or high water levels. Appropriate locations for the placement of nesting structures will be determined using aerial imagery in ArcGIS and field surveys looking for a combination of landowner permission, accessibility, islands, wetland vegetation, tributaries, backwaters, embayments, and previous breeding records. In addition to the nesting structures, a field crew will perform searches for nests on state and private land (where landowners have given permission). Mallards nest in a variety of habitats, so focusing areas for searching is difficult. To the extent possible, the field crew will search the shoreline by boat and adjacent land (up to 0.5 miles from the river) on foot in areas where mallards are likely to be found based on GIS analysis and previous field observations. The tidal Hudson River (Area 4) has an extensive network of state agencies, municipalities, non governmental organizations, and community groups focused on the river. Locating nests in this study area will rely on outreach to this network. A system will be put in place such that when nests are located the field crew will be notified and collect the eggs for analysis.

In contaminant studies using eggs, intra-clutch variability (the variability in contaminant concentrations of eggs from the same clutch) is an important consideration. Although sequentially laid eggs have been documented to have increasing organochlorine contaminants in some species (Mineau 1982, Nisbet 1982), studies of black-crowned night herons (Custer et al. 1990), double-crested cormorants (Custer et al. 1997), glaucous gulls (Verreault et al. 2006), Audouin's gull (Pastor et al. 1995), coots and great

crested grebes (Scharenberg and Ebeling 1997), and common terns (Custer et al. 1983) found little intra-clutch variation in contaminants. Reynolds et al. (2004) and Van den Steen et al. (2006) also found low intra-clutch variability of organochlorine in certain passerine species. Data are not available for mallards or similar waterfowl species to assess intra-clutch variability of PCBs in eggs, but collecting one egg per nest is common in contaminant monitoring protocols (e.g., Canadian Wildlife Service monitoring of contaminants in Great Lakes herring gull eggs). If PCB levels in eggs are found to approach the 0.3 ppm USFDA tolerance, additional evaluation may be required in the future to better assess intra-clutch variability.

Summer 2008 – Juvenile and adult collections

A target of thirty (30) juvenile and thirty (30) adult mallards are to be taken from each sampling area. For adult birds, the study will target an equal sex representation, i.e., 15 males and 15 females, per area. If 30 samples cannot be collected, a minimum of twenty (20) birds per age and area (maintaining a 1:1 sex ratio for adults) may provide an estimate of PCB variability in mallards. Sampling of birds should be conducted of birds on the river or, in wetlands adjacent to the river but at distances no further than 0.25 mile from the river's shoreline. To the extent practicable, all birds should be taken within a two week period for all locations. Specific sampling locations are to be indicated on topographic maps or recorded by GPS coordinates (NAD83 UTM Zone 18N easting and northing). Specimens may be taken by shooting, trapping, or netting when they occur within the specified areas. Collections shall be conducted by NYSDEC personnel, or by cooperating non-NYSDEC personnel as authorized by the issuance of a Scientific Collector's License and compliance with Federal requirements. Sampling data are to be recorded on waterfowl collection records and accompanied by Chain of Custody records (Appendix A).

In addition, **targets of opportunity**, in particular, waterfowl species other than mallards (e.g., wood ducks, mergansers, black ducks, etc.) that are in their **hatch year** are to be collected to provide an assessment of the use of mallards as surrogates, and to expand the scope of a waterfowl injury determination. Up to 20 of these specimens may be taken from the entire upper reach of the river between Fort Edward and Mechanicville, and, similarly, 20 specimens from the lower river between New Baltimore and Newburgh.

2009 – Collection contingencies

Ideally, collection of eggs will occur within the same year that juvenile collections occurred, however, it is anticipated that collection of eggs in a succeeding year will also have validity based on the following considerations: 1) waterfowl, as with other migratory species, tend to return to the areas of their origin; 2) in the absence of either a significant new release of PCBs, or removal of PCBs between years, PCB levels within the river and available for biotic exposures are not anticipated to change significantly between years; 3) PCB exposures on waterfowl migratory routes between years are anticipated to be similar; and 4) normal synchrony of waterfowl behavior would suggest the duration of adult PCB exposures while on the river prior to egg laying would be

similar from year to year. If required sample sizes for the egg collections are not achieved in 2008, the Trustees may collect mallard eggs again in 2009.

E. Chemical analyses

Two types of tissues from juvenile and adult birds are to be analyzed, breast muscle and dissectable subcutaneous fat. However, it is noted that sufficient mass of subcutaneous fat may not be present in juvenile birds, thus, sample numbers for fat tissues of juveniles may be adversely affected.

All chemical analyses shall be conducted by a contract laboratory. Chemical analyses for all samples shall be limited to PCBs (total, the 10 homologs and 48 select congeners, i.e., BZ numbers 8, 18, 28, 31, 44, 45, 47, 49, 52, 56, 66, 70, 74, 77, 81, 87, 95, 99, 101, 105, 110, 114, 118, 123, 126, 128, 138, 146, 149, 151, 153, 156, 157, 158, 167, 169, 170, 174, 177, 180, 183, 187, 189, 194, 195, 201, 206, 209), moisture and lipid content (see section 12).

The progression of chemical analyses will be based on total PCB concentrations in juvenile birds. The progress of chemical analyses may be stopped if fewer than two (2) juveniles within an area contain PCB concentrations at levels greater than the USFDA tolerance for PCBs in poultry. The prioritization of areas targeted for analyses is based on the anticipated PCB findings in waterfowl as generalized from findings for PCB concentrations in fish (Sloan *et al.*, 2002 and 2005), i.e.,

Area 1	Lowest concentrations
Area 2	Highest concentrations
Area 3	Medium to high concentrations
Area 4	Medium to low concentrations

Analysis of all reference area (Area 1) samples shall be conducted regardless of the outcome of PCB analyses. Therefore, the priority of analyses is:

Priority	Area(s)
1	1 + 2
2	3
3	4

If two or more juvenile mallards within an area contain PCB concentrations in excess of the USFDA tolerance for PCB, adult mallards and mallard eggs collected in the area will be analyzed and followed by analysis of juvenile waterfowl species that are targets of opportunity.

Quality control samples to be run with waterfowl samples shall be compliant with the recommendations of the Hudson River Natural Resource Trustees Analytical Quality Assurance Plan (HRNRT 2005).

F. Statistical assessment

Statistical assessments are necessary to determine if there is a natural resource injury resulting from the presence of PCB in waterfowl and to quantify the extent of that injury. The questions to be answered are:

- Do PCB concentrations in waterfowl fat or breast muscle exceed the USFDA tolerance of 3.0 parts per million (fat basis)?

- What proportions of mallard eggs, juveniles, and adults in each area, (including by age and sex where appropriate), exceed their respective USFDA tolerance?

- What contribution to total PCB loads in juvenile mallards was made by the adult female through transfer of PCBs to the egg?

- Are there spatial differences in PCB concentrations in eggs, juveniles, and adults, particularly with respect to the reference area?

For the first two questions, the Trustees will test the data to determine homogeneity of variance, use simple descriptive statistics, if applicable, and determine the proportion of samples that exceed the USFDA tolerance. If data are not normally distributed, appropriate transformations will be applied to ensure data distributions approach normality. Statistical techniques which involve bootstrap analysis with replacement of data (STATXACT) to determine the proportion of birds exceeding the USFDA tolerance, and the confidence intervals of those proportions, will be conducted. The tests will be conducted by area, species (where sufficient sample numbers are present), age and sex of the birds. When probabilities are less than 0.05 significant differences or exceedances will be indicated.

The third question will be addressed by comparing the mass of PCBs in mallard eggs to the mass of PCBs in juvenile mallards. Since PCBs in juvenile birds are only being determined for muscle and adipose tissues (dissectable fat) of juvenile birds, either the portions analyzed can be used to produce a minimal estimate of PCB mass, or extrapolation to the whole bird can be made to produce a more realistic estimate of PCB mass in the juvenile bird. Any differences in PCB mass between the egg and the juvenile must be considered a conservative calculation of PCB accumulation as being derived principally from PCB sources within or along the Hudson River, because some of the PCB mass transmitted from the mother is likely derived from the Hudson as well.

For the fourth question, PCBs in mallard eggs, breast muscle, and subcutaneous fat will be compared between birds from reference areas and from downstream Hudson River locations. Two statistical tests may be used. A Kruskal-Wallis test may be used to compare PCB concentrations in mallards, by age and sex, collected from each areas of the river. The Trustees will use the Kruskal-Wallis test to determine if there are significant differences at $p<0.05$. The second test proposed will compare exact confidence interval proportions (determined through use of STATXACT) to determine spatial differences in proportional exceedance of the FDA tolerance for PCB in poultry. When probabilities are less than 0.05 significant differences will be indicated.

8. Environmental Outputs/Outcomes/Deliverables:

Outputs:

Collect data indicating levels of PCBs and lipids in resident mallards as a surrogate for all resident waterfowl representing the full length of the Hudson River. Data for other resident species, as available, may be provided.

Outcomes:

This study represents a more detailed assessment of PCB concentrations in resident waterfowl taken from the Hudson River than those conducted previously and, therefore, will be used to produce a current and comprehensive data set for PCB and lipid concentrations in edible tissues of resident mallards from the Hudson River, and to produce a similar data set for other waterfowl, as available.

This study will determine the proportions of resident waterfowl that exceed the USFDA tolerance for PCBs in poultry or eggs, as appropriate. Further, spatial differences in the distribution of PCBs in waterfowl will be examined.

Deliverable:

A final report which provides data summaries and analysis in fulfillment of the objectives and outcomes of this study will be produced.

9. Schedule of Tasks and Products:

Activity	Time frame
Sampling	
Mallard eggs	April-May 2008
Juvenile and adult birds	Late July - early August 2008
Sample preparation and shipping	
Juvenile and adult birds	September - October 2008

Mallard eggs	April-June 2008
Chemical analysis	October 2008 - June 2009
Data entry and analysis	February - July 2009
Reporting	
Draft report to the Trustees	September 2009
Peer review	November 2009
Final report to the Trustees	December 2009

10. Project Organization and Responsibility:

Overall management details are depicted in Figure 2.

11. Data Quality Requirements and Assessments:

The analytes that may be examined, their detection and quantitation limits, estimates of accuracy and precision and analytical methods to be employed are summarized below. The contract laboratory shall be required to report any value which equals or exceeds the detection limit. Appropriate data qualifiers, if required, are to be applied. The Analytical Quality Assurance Plan (Hudson River Natural Resource Trustees (HRNRT) 2005) provides the requirements for quality assurance measurements and the acceptance criteria for evaluating data quality.

Parameter	Waterfowl sample matrix	Detection limit	Quantitation Limit	Estimated Accuracy*	Estimated Precision**	Analytical Method
Lipid	Breast muscle, subcutaneous fat, eggs	0.002 %	0.01 %	± 20 %	≤15 %	Gravimetric
Moisture	Breast muscle, subcutaneous fat, eggs	0.002 %	0.01 %	± 20 %	≤15 %	Gravimetric
Total PCB	Breast muscle, subcutaneous fat, eggs	10 ng/g wet weight	50 ng/g wet weight	50 – 150 %	≤30 % when > 5x MDL	LRMS per Analytical QAP (HRNRT 2005)
PCB homologs	Breast muscle, subcutaneous fat, eggs	10 ng/g wet weight	50 ng/g wet weight	50 – 150 %	≤30 % when > 5x MDL	LRMS per Analytical QAP (HRNRT 2005)
PCB congeners	Breast muscle, subcutaneous fat, eggs	0.1 ng/g wet weight	0.5 ng/g wet weight	50 - 150 %	≤30 % when > 5x MDL	LRMS per Analytical QAP (HRNRT 2005)

12. Calibration Procedures and Preventative Maintenance:

Normal operating procedures at contract laboratories are specified by contract with the laboratory but are expected to include rigorous periodic inspections of: chemical assay procedures and validation, reagent preparation and labeling, quality control samples and standards, instrument calibration and maintenance, analytical results, data recording, analysis and archiving of data. An internal operating procedure manual detailing use, calibration and maintenance is kept with each item of analytical equipment.

Instrument calibration will use a five-point curve for all analytes. The relative standard deviation (%RSD) of ≤ 20 % for all analytes is acceptable, although up to 10 % of PCB congeners may have an RSD > 20 % but < 30 % (HRNRT 2005).

13. Documentation, Data Reduction, and Reporting:

Field data sheets (Appendix A) are initiated at the collection site. Sample data to be recorded include: project name, collection agents, sample location (name and approximate UTM coordinates, or location indicated on a topographic map), date of collection, species, a unique tag number, total weight of specimen (g), sex if it can be determined, other observations of the specimen (e.g., tag numbers if applied by other studies, condition of external structures if other than normal appearing). Chain of

Custody forms (Appendix A) should accompany the specimens with any move or change of person responsible for the samples.

When samples are prepared for shipment to the contract laboratory, Analysis Request forms supplied by the laboratory (preferred) or developed for project use for shipments to the contract laboratory are to be completed. The original is to be provided to the contract laboratory. A copy of the collection records and chain of custody are to be provided to the principal investigator at the time of shipment of samples to the contract laboratory. Field offices should also retain a copy for their records. The data on these records shall be entered into the NYSDEC's computer database.

All data generated by the laboratory produces a hard copy report and is stored in computer data files in the laboratory. The analytical results will be reviewed for quality assurance/quality control concerns prior to submission to the principal investigator. The analytical results, and the attendant quality assurance review, are sent to the principal investigator in both paper and electronic forms. The principal investigator will compile the data in the NYSDEC data dictionary format (Appendix B), tabulated, subjected to statistical analyses and reported as appropriate with explanatory text.

14. Data Validation:

See Table 4 regarding assessments of field and laboratory operations and the resultant data for the purpose of validation and assessments of data usability. The table addresses some of the potential foreseeable issues, but is not inclusive of all potential issues that might arise. Table 4 attempts to characterize those issues most likely to be a concern. Other issues that may arise must be addressed individually by the principal investigator. Validation of laboratory data will be conducted in accordance with methods and criteria described in the Analytical Quality Assurance Plan (HRNRT 2005).

15. Performance and System Audits:

Field and laboratory audits will help assure that the project is conducted in the manner specified within the Quality Assurance Project Plan (QAPP). A large number of factors may impinge on the samples being collected, their handling, and the conduct of chemical analyses. It is not possible to anticipate all the factors that may potentially affect the conduct of the project, nor all the corrective actions, if necessary, that may need to be conducted. The general description for conduct of audits is included below.

An on-site field audit will be conducted by the Hudson River Quality Assurance Coordinator, or the Coordinator's designee, to assure compliance with good field practices and to assure proper collection, handling and measurement of specimens. The findings of the audit will be documented in writing and shall include observations on compliance with or deviations from the QAPP. Where deviations occur, and those deviations do not adversely impact the project, a rationale for the judgment shall be

included. Where deviations require corrective actions, those recommendations shall be recorded and follow-up to assure compliance with recommended actions is required. If any deviations will substantially affect the quality of the data or the findings of the study, those opinions and rationale shall be recorded. In the latter event, the principal investigator shall consider the audit findings and take appropriate actions during the evaluation and reporting of data.

An on-site audit of the contract laboratory will not be conducted for the project. As an alternative, the contract laboratory shall analyze at least one standard reference material or Hudson River reference sample for each batch of samples (maximum of 15 samples per batch) analyzed. NYSDEC will supply Hudson River standard reference material to provide an independent measure of the laboratory overall quality control and auditing procedures. The laboratory should also obtain reference material available from National Institute of Standards and Testing. In addition, the contract laboratory will maintain internal systems for quality control and auditing, and they shall provide their interpretation of the data quality based on the laboratories QA/QC procedures and criteria, and where warranted, will provide data qualifiers.

16. Corrective Actions:

All corrective actions taken pursuant to field or laboratory audits shall be recorded in writing, and shall be evaluated by the principal investigator, where the auditor and the principal investigator believe they may significantly affect the findings of the study. The recommendations of the principal investigator shall be incorporated into data management, analysis and interpretation, and the final report.

Some examples of recommended corrective actions for potential adverse findings of the auditor(s) follow:

• If field data or chain of custody information are not complete or obviously incorrect and biological data cannot be corrected, the sample(s) will be discarded prior to analysis.

• If contamination of a (any) sample(s) has (have) occurred, the sample(s) will be discarded prior to shipment for chemical analysis.

• If sample preparation differs from the QAPP and chemical analyses have occurred, but contamination did not occur or is not likely to have occurred during sampling or preparation, the preparation procedures shall be documented and necessary qualifiers shall be incorporated in evaluation of the data. Where remaining portions of the specimen are available and are in acceptable condition, an appropriate sample can be taken and be substituted for inappropriate sample portions. For samples taken thereafter, the sample preparation methods within the QAPP must be complied with.

• Portions of specimens remaining after sample collection shall be stored frozen until lab results are verified. If a laboratory accident or shipping problem necessitates discarding a

sample, any remaining sample portion held in storage may be substituted and analyzed, where necessary.

• If data produced fall outside data quality limits, appropriate data qualifiers shall be applied. Where sample data are qualified, the impact of the qualifiers on the use of the data will be evaluated by the principal investigator. If there is a significant impact on the use of the data, the recommendations of the principal investigator shall be incorporated into the final report.

17. Reports:

Reporting shall occur at several points in time and is dependent on the purposes of reporting. For project management, monthly reporting of the status of sample collection, sample preparation and shipment to contract laboratories is to be provided to the principal investigator. As necessary, project status reporting to the Trustees shall occur.

18. References Cited:

Baker, F., C. Tumasonis, W. Stone, and B. Bush. 1976. Levels of PCB and trace metals in waterfowl in New York State. NY Fish Game J. 23:82-91.

Bishop, R.A. and R. Barratt. 1969. Capturing waterfowl in Iowa by night-lighting. Journal of Wildlife Management. 33:956-960.

Chouinard, M.D., R.M. Kaminski, P.D. Gerard, and S.J. Dinsmore. 2005. Experimental evaluation of duck nesting structures in Prairie Parkland Canada. Wildlife Society Bulletin 33:1321–1329.

Custer T.W., C.M. Custer, and K.L. Stromborg. 1997. Distribution of organochlorine contaminants in double-crested cormorant eggs and sibling embryos. Environmental Toxicology and Chemistry 16:1646–1649.

Custer, T.W., R.M. Erwin, and C. Stafford. 1983. Organochlorine residues in common tern eggs from nine Atlantic coast colonies, 1980. Colonial Waterbirds 6: 197-204.

Custer, T.W., G. Pendleton, and H.M. Ohlendorf. 1990. Within and among-clutch variation of organchlorine residues in eggs of black-crowned night herons. Environmental Monitoring and Assessment 15:83-89.

Drilling, N., R. Titman, and F. McKinney. 2002. Mallard (*Anas platyrhynchos*). *In*: The Birds of North America, No. 658. (A. Poole and F. Gill, *eds*.) The Birds of North America, Inc., Philadelphia, PA.

Eskowich, K.D.,D. McKinnon, G. Brewster, and K. Belcher. 1998. Preference and use of nest baskets and nest tunnels by mallards in the parkland of Saskatchewan. Wildlife Society Bulletin 26:881–885.

Foley, R. E. 1992. Organochlorine residues in New York waterfowl harvested by hunters in 1983-1984. Environmental Monitoring and Assessment 21:37-48.

Foley. R. E., and G. R. Batcheller. 1988. Organochlorine contaminants in common goldeneye wintering on the Niagara River. Journal of Wildlife Management 52:441-445.

Harrison, M.K., Sr., G.M. Haramis, D.G. Jorde, and D.B. Stotts. 2004. Capturing American black ducks in tidal waters. Journal of Field Ornithology 71:153-158.

Hudson River Natural Resource Trustees. 2005. Analytical Quality Assurance Plan Hudson River Natural Resource Damage Assessment, Version 2.0. Hudson River Natural Resource Trustees. 31 p.

Johnson, R.R., K.F. Higgins, I.J. Ball, and S.C. Kohn. 1994. Waterfowl productivity and use of nesting structures in the prairie pothole region. Prairie Naturalist 26:187–194.

Kim, H. T., K. S. Kim, J. S. Kim, and W. B. Stone. 1985. Levels of polychlorinated biphenyls (PCBs), DDE, and mirex in waterfowl collected in New York State, 1981-1982. Archives of Environmental Contamination and Toxicology 14:13-18.

Kim, K. S., M. J. Pastel, J. S. Kim, and W. B. Stone. 1984. Levels of polychlorinated biphenyls, DDE, and mirex in waterfowl collected in New York State, 1979-1980. Archives of Environmental Contamination and Toxicology 13:373-381.

Lindmeier, J.P. and R.L. Jessen. 1961. Results of capturing waterfowl in Minnesota by spotlighting. Journal of Wildlife Management 25:430-431.

Mineau, P. 1982. Levels of major organochlorine contaminants in sequentially-laid herring gull eggs. Chemosphere 11:679-685.

Nisbet, I.C.T. 1982. Eggshell characteristics and organochlorine residues in common terns: variation with egg sequence. Colonial Waterbirds 5:139-143.

O'Keefe, P. W., W. C. Clayton, S. Connor, B. Bush, and C.-S. Hong. 2006. Organic pollutants in wild ducks from New York state: I. Interspecies differences in concentrations and congener profiles of PCBs and PCDD/PCDFs. Science of the Total Environment 361:111-123.

O'Keefe, P., D. Hilker, C. Meyer, K. Aldous, L. Shane, R. Donnelly, R. Smith, R. Sloan, L. Skinner and E. Horn. 1984. Tetrachlorodibenzo-*p*-dioxins and tetrachlorodibenzofurans in Atlantic Coast striped bass and in selected Hudson River fish, waterfowl and sediments. Chemosphere 13:849-860.

Pastor, D., L. Jover, X. Ruiz, and J. Albaiges. 1995. Monitoring organochlorine pollution in Audouins gull eggs - the relevance of sampling procedures. Science of the Total Environment 162:215-223.

Reynolds, K.D., S.L. Skipper, G.P. Cobb, and S.T. McMurry. 2004. Relationship between DDE concentrations and laying sequence in eggs of two passerine species. Archives of Environmental Contamination and Toxicology 47: 396-401.

Scharenberg, W. and E. Ebeling. 1998. Organochlorine pesticides in eggs of two waterbird species (*Fulica atra, Podiceps cristatus*) from the same habitat: Reference site Lake Belau, Germany. Chemosphere 36: 263-270.

Skinner, L. C. 1992. Chemical contaminants in wildlife from Akwesasne and the vicinity of the General Motors Corporation/Central Foundry Division Massena, New York plant. Tech. Rep. 92-4 (BEP). Division of Fish and Wildlife, New York State Department of Environmental Conservation, Albany, NY. 113 p.

Sloan, R. J., M. W. Kane, and L. C. Skinner/. 2002. 1999 as a special spatial year for PCBs in Hudson River fish. Division of Fish, Wildlife and Marine Resources, New York State Department of Environmental Conservation, Albany, NY. 34 p. + 16 tables + 22 figures.

Sloan, R. J., M. W. Kane, L. C. Skinner. 2005. Of time, PCBs and the fish of the Hudson River. Division of Fish, Wildlife and Marine Resources, New York State Department of Environmental Conservation, Albany, NY. 287 p.

Swift, B. L., R. E. Foley, and G. R. Batcheller. 1993. Organochlorines in common goldeneyes wintering in New York. Wildlife Society Bulletin 21:52-56.

Van den Steen, E., T. Dauwe, A. Covaci, V.L.B. Jaspers, R. Pinxten, and M. Eens. 2006. Within- and among-clutch variation of organohalogenated contaminants in eggs of great tits (*Parus major*). Environmental Pollution 144:355-359.

Verreault, J., R. A. Villa, G. W. Gabrielsen, J. U. Skaare, and R. J. Letcher. 2006. Maternal transfer of organohalogen contaminants and metabolites to eggs of Arctic-breeding glaucous gulls. Environmental Pollution 144:1053-1060.

Table 1: PCB residue concentrations in several tissues of wild ducks collected along the Hudson River over time.

Species	Date collected (mon/yr)	Location (county)	n[1]	PCB (µg/g wet weight) in:					Ref.[2]
				Sub-cutaneous fat	Breast muscle	Liver	Brain	Other	
American merganser	12/1981	Ulster	1	124	6.3	na[3]	na		1
Black duck	10/1979	Columbia	6	8.17±6.71 2.7-19	0.15±0.072 0.06-0.27	0.73 0.45-1.0 (2)	<0.010 (2)		2
	10/1981	Columbia	9	5.81±3.74 0.59-12	0.23±0.18 0.05-0.54 (8)	na	na		1
	11-12/1981	Ulster	9	7.58±7.12 0.61-20 (8)	0.26±0.17 0.11-0.69	0.23 0.16-0.29 (2)	na		1
	Fall 1983 + 1984	Hudson-Champlain corridor	11	7.8±13.4 <0.1-43 (10)	0.11±0.14 <0.1-0.5	na	na		5
Blue-winged teal	10/1979	Columbia	3	11.4±4.98 6.1-16	0.78±0.44 0.32-1.2	0.78±0.51 0.28-1.3	na		2
Bufflehead	10/1979	Columbia	1	0.24	0.05	0.07	na		2
	Fall 1983 + 1984	Hudson-Champlain corridor	12	3.1±7.9 0.2-28.0	0.09±0.11 <0.1-0.4 (10)	na	na		5
Canada goose	Prior to 1976	Albany (presumed Hudson River)	2	na	<0.5	<0.5	<0.5		4
Canvasback	12/1981	Ulster	5	4.32±4.94 0.98-13	0.26±0.27 0.11-0.66 (4)	na	na		1
	Fall 1983 + 1984	Hudson-Champlain corridor	14	0.2±0.2 <0.1-0.6 (13)	<0.1	na	na		5
Gadwall	10/1979	Columbia	1	3.6	0.20	na	0.12		2
Green-winged teal	10/1979	Columbia	3[4]	0.60 0.51-0.69 (2)	0.26 0.22-0.29 (2)	na	0.52 0.05-0.98 (2)		2
	10/1981	Columbia	1	0.81	0.27	na	na		1
Hooded merganser	10/1981	Columbia	1	45	1.6	na	na		1
	May 7, 1998	SA13 Moreau (Saratoga)	2/1	na	na	na	na	98.0 (egg contents)	6

Species	Date collected (mon/yr)	Location (county)	n[1]	PCB (µg/g wet weight) in:					Ref.[2]
				Sub-cutaneous fat	Breast muscle	Liver	Brain	Other	
Mallard	10/1979	Columbia	15	6.69±7.63 0.01-26	0.40±0.23 0.05-0.79	0.52±0.51 0.05-1.6 (12)	0.46±0.78 0.02-3.0 (14)		2
	10/1981	Columbia	13[5]	5.16±4.94 0.34-14 (10)	0.31±0.27 0.07-1.1 (12)	0.23 (1)	na		1
	10/1994	Washington	1	na	na	0.367	na		3
	Fall 1983 + 1984	Hudson-Champlain corridor	7	8.9±9.2 <0.1-22.7	0.12±0.10 <0.1-0.3	na	na		5
	August 30, 1995	SA13, Moreau (Saratoga)	2/1	na	na	na	na	4.022 (whole bird minus feet and beak)	6
	May 12, 1995	Saratoga National Historic Park	3/1	na	na	na	na	1.135 (egg contents)	6
	December 19, 2000	2.1 mi. S of Rte. 29 (Washington)	4	3.42 ± 2.97 1.43 - 7.83	0.075 ± 0.041 0.041 - 0.129	na	na		7
Scaup	Prior to 1976	Westchester (presumed Hudson River)	3	na	2.7±2.4 1.0-5.5	3.2 1.0-5.4 (2)	6.75 1.0-12.5 (2)		4
	Fall 1983 + 1984	Hudson-Champlain corridor	6	4.1±4.8 0.5-9.3 (5)	0.14±0.11 <0.1-0.3	na	na		5
Shoveller	10/1981	Columbia	1	8.8	0.30	na	na		1
Surf scoter	10/1979	Columbia	1	14	0.71	0.69	na		2
White-winged scoter	10/1979	Columbia	2	8.2 5.4-11	0.58 0.22-0.94	0.65 0.47-0.83	0.26 (1)		2
Wood duck	10/1981	Columbia	4	3.14±3.93 0.64-9.0	0.095±0.017 0.08-0.12	na	na		1
	10/1994	Washington	2	na	na	0.067 0.065-0.069	na		3

Species	Date collected (mon/yr)	Location (county)	n[1]	PCB (µg/g wet weight) in:					Ref.[2]
				Sub-cutaneous fat	Breast muscle	Liver	Brain	Other	
	Fall 1983 + 1984	Hudson-Champlain corridor	15	0.6±0.8 <0.1-3.5	0.05±0.01 <0.1-0.1	na	na		5
	August 31, 1995	Griffin Island (Saratoga)	1	na	na	na	na	0.254 (whole bird minus feet and beak)	6
	August 31, 1995	Hot Spot #35 Schuylerville (Saratoga)	2/1	na	na	na	na	0.290 (whole birds minus feet and beaks)	6
	May 5, 1995	Griffin Island (Saratoga)	2/1	na	na	na	na	1.432 (egg contents)	6
	May 7, 1998	Griffin Island (Saratoga)	2/1	na	na	na	na	3.10 (egg contents)	6

[1] n = number of samples analyzed unless otherwise indicated in parenthesis in tissue columns. x/y = number of birds/number of samples (composite samples).
[2] References from which data were obtained are: 1 = Kim *et al*. (1985); 2 = Kim *et al*. (1984); 3 = O'Keefe *et al*. (2006); 4 = Baker *et al*. (1976); 5 = Foley (1992); 6 = Personal communications between Donald Tillitt and Anne Secord dated April 15, 1997, and between Anne Secord and Larry Skinner dated October 18, 2006; 7 = NYSDEC unpublished data.
[3] na = No analyses.
[4] Three green-winged teal were taken but only two differing birds analyzed for each tissue.
[5] Thirteen mallards were taken but differing numbers of birds were analyzed for each tissue.

Table 2: Other chemical residues found in breast muscle or subcutaneous fat of migratory waterfowl taken in the Hudson-Champlain corridor[1].

Species	Concentration[2] and (number of samples analyzed)				
	Total DDT (µg/g)		Dieldrin in fat (ng/g)	Total chlordane in fat (ng/g)	HCB in fat (ng/g)
	Muscle	Fat			
Bufflehead	0.007 ± 0.009 (10)	0.400 ± 0.523 (11)	17 ± 13 (12)	112 ± 179 (13)	22 ± 14 (12)
Scaup	0.030 ± 0.014 (4)	0.929 ± 1.121 (5)	178 ± 26 (5)	40 ± 47 (6)	31 ± 19 (5)
Mallard	0.061 ± 0.088 (4)	2.823 ± 4.159 (7)	48 ± 27 (7)	179 ± 155 (13)	19 ± 12 (7)
Black duck	0.006 ± 0.007 (7)	0.537 ± 0.434 (10)	36 ± 29 (10)	94 ± 168 (10)	14 ± 12 (10)
Wood duck	0.005 ± 0.004 (10)	0.547 ± 1.011 (15)	6 ± 2 (15)	30 ± 38 (16)	<DL[3] (15)
Canada goose	0.009 ± 0.009 (8)	0.213 ± 0.197 (12)	13 ± 21 (13)	15 ± 9 (13)	6 ± 4 (13)

[1] Source: Foley (1992).
[2] All concentrations on a wet weight basis.
[3] Detection limit is 10 ng/g.

Table 3: Concentrations of 2,3,7,8-TCDD and 2,3,7,8-TCDF in adipose tissue of migratory waterfowl taken from the Catskill area of the Hudson River during November 1980[1].

Species	Number of birds in sample	Concentration (pg/g wet weight)	
		2,3,7,8-TCDD	2,3,7,8-TCDF
Black duck	6	<DL (45)	79
Mallard	12	<DL (26)	44
Wood duck	1	<DL (88)	13

[1] Source: O'Keefe *et al*. (1984).

Table 4: Review, verification, and validation of project processes and data

Activity/Record	Performance standard	Potential Issues	Response	Usability	Responsibility
Field activities					
Specimens collected	• Specimens collected per QAPP	Incorrect sampling locations, species, sizes, or seasons	Assess ability to meet sampling requirements; resample if practical	Assess usability of samples for purposes of project; if insufficient, do not analyze; record events	Sean Madden and Bryan Swift, NYSDEC
		Collection methods used other than those specified	Assess reliability and quality of alternative methods; if volunteers are used, provide training prior to collection and monitor compliance	If methods are acceptable; use samples; if not acceptable; discontinue sample method and discard samples; record event(s)	
	• Number of specimens meets QAPP needs	Insufficient number of specimens	Assess capability to collect more samples; conduct additional sampling, if practical	Assess usability of samples for purposes of project; if insufficient, do not analyze	
	• No sample contamination	Sample contamination	Discard specimens	Not usable for project	
Sample field data	• Collection record data complete	Incomplete data	Obtain missing data, if possible	If data is incomplete, assess usability; do not analyze samples with insufficient sample data	Sean Madden and Bryan Swift, NYSDEC
	• Unique identifier applied	No unique identifier	If sample history is known, apply identifier; if not, discard specimen	See response	
	• Chain of custody record complete	No or incomplete chain of custody	If sample history is known, complete chain of custody; if not, discard specimen(s)	See response	

Activity/Record	Performance standard	Potential Issues	Response	Usability	Responsibility
Sample preservation and storage	• Specimens chilled in field	Specimen not chilled	Assess condition; if acceptable, chill immediately; if not, discard	See response; make record of event	Sean Madden and Bryan Swift, NYSDEC, and Anthony Gudlewski, NYSDEC Hale Creek Field Station
	• Specimens frozen after data collection	Samples not frozen	Assess condition; if acceptable, freeze; if not, discard	See response; make record of event	
	• Samples shipped to field lab under chain of custody procedures	No chain of custody forms	Obtain and complete chain of custody forms if custody is known; if not discard specimens	See response	
		Shipping container not secured	Secure container if prior to shipment; if at lab, determine if container and specimens were continuously in custody of agent, if yes, accept; if not, discard	See response	
	• Freezer is locked	Freezer not locked	Lock freezer; assess potential for tampering; record incident, conduct assessment and make decision	See response; if tampering is suspected, discard specimens	
	• Freezer maintains appropriate temperatures	Freezer failure	Call repair service; assess condition of samples: samples frozen or partially frozen, acceptable; samples thawed but cold, marginal but acceptable if refrozen immediately; samples warm, unacceptable, discard	See response; make record of event and outcome; consider for inclusion in final report	
	• Freezer temperature recorded daily	No freezer temperature record	Cause initiation and maintenance of a daily record	See response; samples, if frozen, are acceptable for use	

Activity/Record	Performance standard	Potential Issues	Response	Usability	Responsibility
Sample preparation	• Sample portions taken per QAPP	Sample portion is not as stated in QAPP	If specimen still available and usable, take appropriate sample from carcass; if not, discard	See response; make record of event	Sean Madden, NYSDEC and Anthony Gudlewski, NYSDEC Hale Creek Field Station
	• Packaged properly	Improper packaging	Assess sample quality: if compromised, discard; if acceptable, repackage properly	See response; make record of event	
	• Labeled properly	Improper labeling	If sample identity can be determined, apply proper labeling; if not, discard sample	See response; make record of event if sample is discarded	
	• Sample frozen following preparation	Sample not frozen	Assess sample quality: if compromised, discard; if acceptable freeze	See response; make record of event	
	• Freezer locked	Freezer not locked	Lock freezer; determine whether samples may have been compromised; take appropriate actions based on findings	See response; make record of event; determine usability of sample	
Sample transport to laboratory	• Sample delivery is timely	Carrier did not deliver samples in timely fashion	Assess condition of samples; if frozen or partially frozen, acceptable; if thawed but cold marginally acceptable but make record; if warm, unacceptable - consult with principal investigator	See response; make record of condition of sample(s) upon receipt and sample disposition	NYSDEC, Hale Creek Field Station; Alpha Woods Hole Lab
	• Shipment/samples delivered frozen	Sample(s) not frozen	If thawed but cold, acceptable but make note for record; if warm, unacceptable and lab should consult with principal investigator	See response; make record of condition of sample(s) upon receipt and sample disposition	
	• Analytical request included	No analytical request	Complete request form and send to laboratory	No impact on use of samples	

Figure 1A: Sampling areas for the project "Determining PCBs in Hudson River Resident Waterfowl: 2007 Field Season"; Areas 1 thru 3.

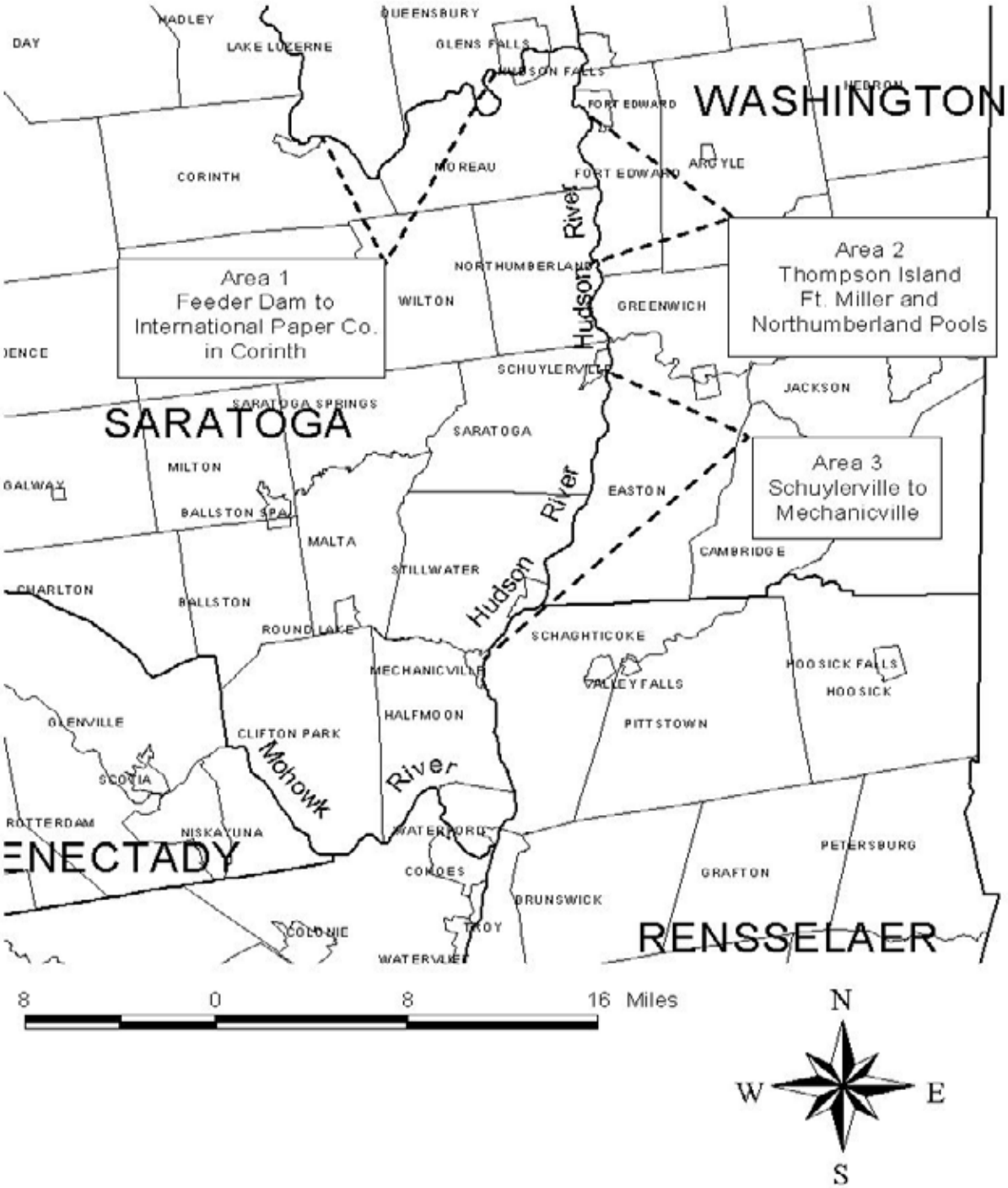


Figure 1B: Sampling area for project "Determining PCBs in Hudson River Resident Waterfowl: 2007 Field Season"; Area 4.

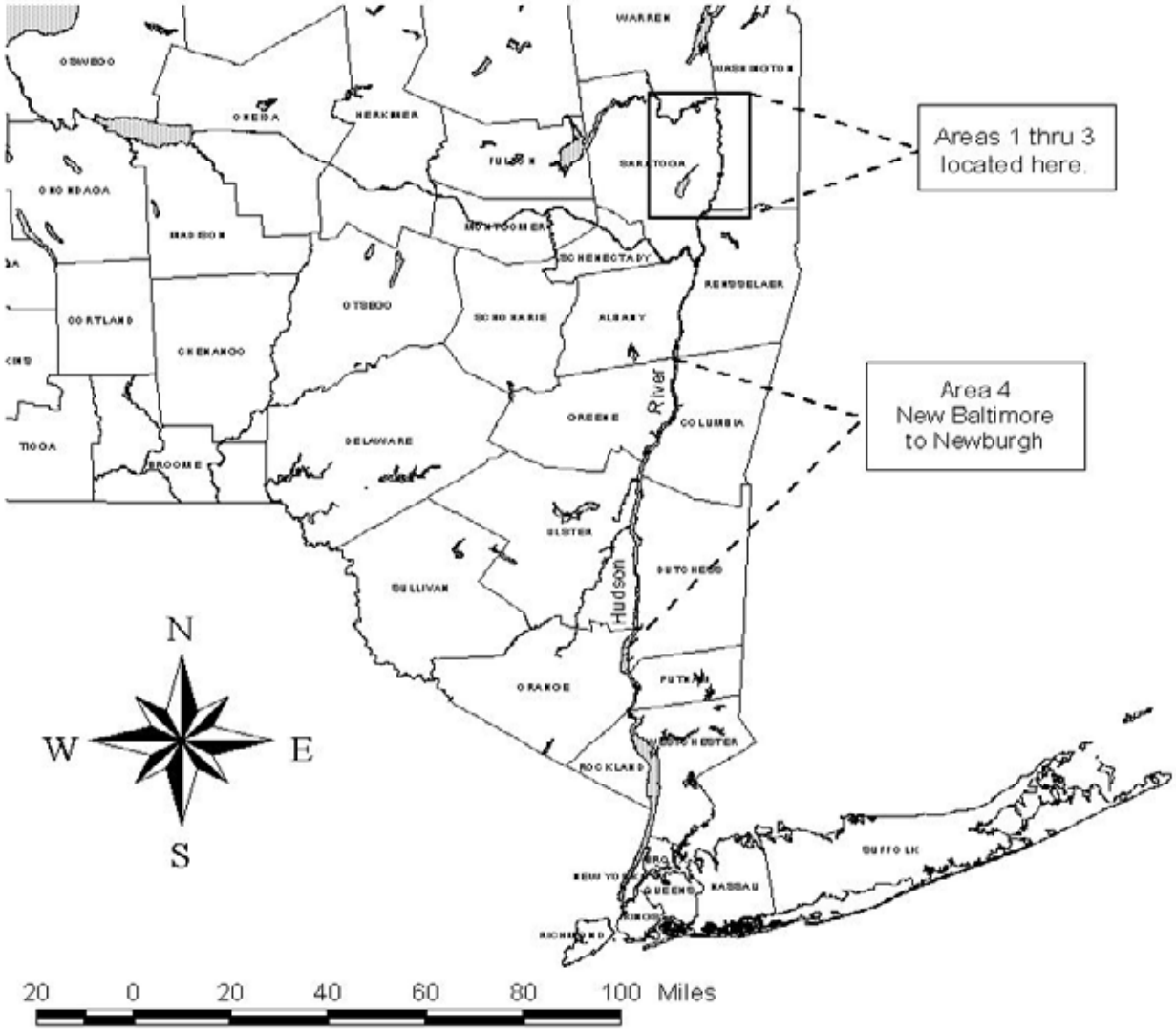
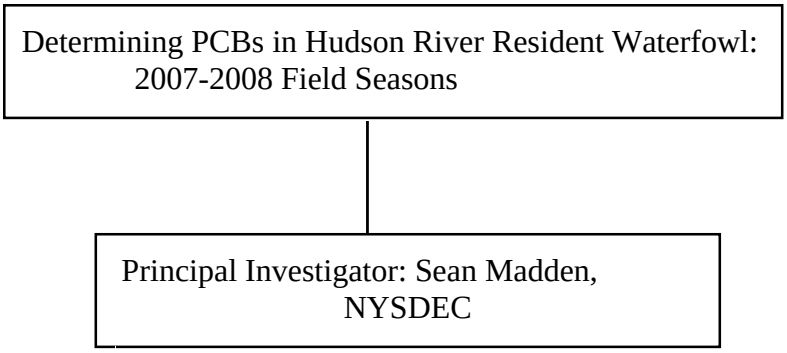


Figure 2: Schematic of project organizational responsibilities.



- Collections: Sean Madden and Brian Swift, NYSDEC

- Sample preparation and shipment to laboratory: Sean Madden and Anthony Gudlewski, NYSDEC

- Chemical analyses:
  Maura Surprenant
  Alpha Analytical
  320 Forbes Blvd.
  Mansfield, MA 02767
  Telephone: 508-844-4110
  Email: msurprenant@alphalab.com

- Data quality review: Hudson River Quality Assurance Coordinator

- Data analysis and reporting: Sean Madden, NYSDEC

APPENDIX A

STANDARD SAMPLE HANDLING FOR WATERFOWL

Project: Determining PCBs in Hudson River Resident Waterfowl: 2007-2008 Field Seasons

Standard sample handling and preparation procedures for waterfowl

These juvenile and adult waterfowl sample handling and preparation procedures were developed specifically for the above referenced project. These egg-processing procedures were developed by the U.S. Fish and Wildlife Service and modified for the project based on consultation with the Quality Assurance Coordinator for this project. These procedures are to be implemented from the point of taking of the waterfowl specimens and until the resulting samples are delivered to a laboratory for chemical analysis. The procedures follow.

I. Juvenile and adult birds

A. Specimen handling prior to sample preparation

1. Once a specimen is taken in the field, it is to be placed immediately in an ice chest and chilled to 40º F or cooler. The identity of the location of collection for each bird must be maintained.

2. Specimen records: Separate Collection Record forms must be completed each day at each location. If cooperating hunters are involved, a separate Waterfowl Collection Record form must be maintained for each hunter. Determine and record on the Waterfowl Collection Record the specimen's species identity, date and location of taking, sex and age. Measure and record total weight to the nearest 10 g (specimen should be dry and without attached or adhered debris prior to weighing) and record. Record in the notes column any information from any tags attached to the specimen at the time of taking (e.g., leg bands), or other unusual observations (e.g., deformities, blindness, etc.).

3. Attach a tag to the specimen having a unique identifying number. Record this number in the Specimen ID No. column of the Waterfowl Collection Record. The nomenclature for the Specimen ID. No. should be in accord with the following example:

A1 MAL j M 01

where the first two characters are the area of collection, i.e.,
A1 = Area 1, the reference area, between the Feeder Dam and International Paper Company at Corinth;
A2 = Area 2 between Fort Edward and Northumberland;
A3 = Area 3 between Schuylerville and Mechanicville; and
A4 = Area 4 from New Baltimore to Newburgh.

The next three characters indicate species group, i.e.,
MAL = mallard;

TOP = target of opportunity.

The fourth character represents age of the bird, i.e.,
j = juvenile;
a = adult;
e = egg.

The fifth character is the sex of the bird (no sex can be assigned to eggs), i.e.,
M = male; and
F = female.

The last two characters represent the number of the specimen within the classification represented by the preceding characters. There are the following maximum numbers of birds within each group of birds per location.

Mallard juveniles = 30 (regardless of sex);
Mallard adult males = 15;
Mallard adult females = 15;

Target of Opportunity (total) juveniles = 20 from between Fort Edward and Mechanicville; and
Target of Opportunity (total) juveniles = 20 from between New Baltimore and Newburgh.

4. Place specimen in a clear food grade plastic bag. Tie bag. Attach a manila ID tag to the outside of bag. This tag is to have the following information: Abbreviated project name (e.g., HR Waterfowl Study), species identity, location, date, and specimen tag number.

5. Place field processed specimen back into cooler.

6. Complete Chain of Custody form for each day's and location's collection. If cooperating hunters are involved, a separate record must be made for specimens taken by each hunter on each day. Cooperating hunters must sign the Chain of Custody form and be made aware of the terms of the Notice of Warranty on the reverse side of the Chain of Custody form.

7. Transport specimens to the frozen storage facility. All specimens should be in the custody of one Department employee or their designee at all times. Freeze specimens as soon as possible on the day of collection.

8. Make a copy of the Waterfowl Collection Record and Chain of Custody forms for sampler's records. The original Waterfowl Collection Record and Chain of Custody forms are to remain with the samples during all future transactions.

B. Transport of samples to field laboratory

1. Specimens are to be retrieved from the freezer and placed into a cooler or ice chest with ice, dry ice or ice packs to maintain the frozen state of the specimens. Close cooler/ice chest and place a seal (e.g., packing, masking or duct tape) from one side across the lid to the other side of the container. Sign and date the seal with an indelible marker. This becomes the chain of custody seal.

2. Sign and complete each Chain of Custody form to acknowledge receipt of the samples.

3. Transport samples to the field laboratory at the Hale Creek Field Station, 182 Steele Avenue Extension, Gloversville, NY 12078. Notify Anthony Gudlewski (518-773-7318) prior to shipment.

4. The person receiving the samples at the field laboratory must check to assure that the Chain of Custody seal is unbroken. If the seal is broken, it must be noted on the Chain of Custody form in the Purpose of Transfer block. Break the seal to check the contents of each container to assure all specimens are present, and accept receipt of the samples by signing the Chain of Custody form. A copy of the signed Chain of Custody form shall be provided to the person delivering the specimens.

5. Once specimens are accepted at the field laboratory, the specimens are to be placed into locked frozen storage until sample preparation is to be conducted.

6. If desired by the field laboratory, individual unique field laboratory identification numbers should be assigned to specimens at this time. Each laboratory number will be placed in the Laboratory ID No. Column adjacent to the corresponding Specimen ID No. on the Waterfowl Collection Record form. The field laboratory ID number shall be in the following format: #### - ## - H, where the first four # are consecutive numbers assigned to samples as they are received by the laboratory, the next two # are the last two digits of the year of sample receipt, and H represents Hale Creek Field Station.

C. Sample preparation

1. All sample preparation must be conducted in a clean work environment. The sample preparation surfaces and utensils must be cleaned with soap and water, rinsed with hexane, and then rinsed with distilled water between each sample. The preparer must use new latex or nitrile gloves for each sample prepared.

2. Remove specimen from freezer. Allow to thaw either completely or to cold but firm stage.

3. Tare an I-Chem jar that is appropriate for the mass of the sample to be taken.

4. Cut the skin the along midline on ventral side of specimen. Pull back skin from breast muscle. Excise observable subcutaneous fat from the skin and breast muscle and place into a solvent rinsed glass jar, which has been tared (pre-weighed). The preferred mass of subcutaneous fat desired is a minimum of 20 g. Weigh sample (by weighing jar with sample and subtracting jar weight) and record sample weight to the nearest 0.1 g. Place a teflon-lined screw cap on the I-Chem jar. Place an external adhesive label on the I-Chem jar. The label should contain both the Specimen ID No. and the Field Laboratory ID No. (if applicable), the sample type, the initials of the person preparing the sample, and the date of sample preparation. The sample type should be indicated by a suffix ID (m = muscle; f = fat; e = egg) appended to the Specimen ID number, e.g.,

A1 MAL j M 01 f

5. Excise the breast muscles. Assure the breast muscles are devoid of feathers or other debris. Place in tared I-Chem jar. The preferred mass of breast muscle is a minimum of 50 g. Weigh sample (by weighing jar with sample and subtracting jar weight) and record sample weight to the nearest 1.0 g. Place a teflon-lined screw cap on the I-Chem jar. Label the jar with the Specimen ID No. and the Field Laboratory ID No. (if applicable), the sample type, the initials of the person preparing the sample, and the date of sample preparation. The sample type should be indicated by a suffix ID (m = muscle; f = fat; e = egg) appended to the Specimen ID number, e.g.,

A1 MAL j M 01 m

6. Re-freeze all samples and maintain in a frozen state at 0º F (−18º C). Re-package the remaining carcass with appropriate identification and re-freeze until the project is complete.

D. Sample transport to contract laboratory

1. Samples are to be retrieved from the freezer and placed into a cooler or ice chest with dry ice to maintain the frozen state of the specimens during shipment. Since dry ice is included, the outside of the container must be labeled to indicate the presence and amount (pounds) of dry ice contained therein.

2. Complete the contractor’s Laboratory Analysis Request form. Make a copy for laboratory files. Place completed forms into a clear plastic bag.

3. Sign and complete each Chain of Custody form to acknowledge transfer of the samples for the purpose of transport to the contract laboratory. Make copy of records for laboratory files. Place original completed records, including appropriate Waterfowl Collection Records, into the clear plastic bag with the Laboratory Analysis Request form(s), seal the bag, and place into the shipping container.

4. Close cooler/ice chest and place a seal (e.g., packing, masking or duct tape) from one side across the lid to the other side of the container. Sign and date the seal with an indelible marker. This becomes the chain of custody seal. Attach a completed shipping label on the container.

5. Transport samples to the contract laboratory. Shipments should occur by contract carrier with overnight delivery. All shipments should begin on either Monday, Tuesday or Wednesday to assure delivery prior to the weekend. Avoid deliveries during holiday periods. Samples are to be shipped to:

Maura Surprenant
Alpha Analytical
320 Forbes Blvd.
Mansfield, MA 02767
Telephone: 508-844-4110
Email: msurprenant@alphalab.com

II. Eggs

A. Specimen handling prior to sample preparation

1. Upon collection of an egg in the field, weigh the egg to the nearest 0.1 g, record weight and all other appropriate information as indicated on the Waterfowl Collection Record. Place the egg in a hard container with sufficient padding to protect the egg. Label the container as in I. A. 3. above, and place container in a cooler for transport to Hale Creek Field Station, 182 Steele Avenue Extension, Gloversville, NY 12078. Complete Chain of Custody form.

2. Refrigerate specimens as soon as possible on the day of collection. Refrigerate eggs until opened, ideally no longer than 48 hours. Egg processing will be completed on a daily basis as much as practical. All specimens should be in the custody of one Department employee or their designee at all times.

3. Make a copy of the Waterfowl Collection Record and Chain of Custody forms for sampler's records. The original Waterfowl Collection Record and Chain of Custody forms are to remain with the samples during all future transactions.

B. Sample preparation

1. Fill out the egg processing data sheet. Use one per egg.

2. Rinse the egg in cool water and gently use a sponge to remove any debris. Do not soak the egg.

4. Take three measurements of egg length and maximum egg width using calipers. Compute the average of the three measurements for final egg length and width measurements

5. Measure the total egg volume by water displacement using a graduated cylinder. Fill the graduated cylinder with distilled water and note the starting volume. Immerse the egg using wire loops until the top of the egg is just under the surface of the water. Note the final volume, subtract the starting volume and the volume of the holding apparatus to determine final egg volume. Dry the egg.

6. Wearing nitrile gloves, create a catch basin out of aluminum foil by turning the edges up and securing the corners, so as to catch any egg contents should they spill. The foil can also serve as a clean surface for processing instruments when not in use. Use a separate piece of foil for each sample.

7. Weigh the I-Chem jar with the lid and record the weight on the data sheet. Then place the jar in the center of the aluminum foil and loosen the lid.

8. Score the equator with a scalpel blade. Use a new scalpel blade for each egg. Cradle the egg in one hand, and gently score along the equator while rotating the egg. Continue to evenly score the egg until the membranes are revealed.

9. Remove the lid of the jar. Place the egg over the jar and cut through the membranes with the scalpel. Pour contents into the jar, or use the scalpel or forceps to remove any remaining contents. Note where the membranes are for future egg shell thickness measurements. Record the estimated stage of embryo development or any other notes. Remove any shell fragments from the jar using forceps. Cover the jar and record the weight to the nearest 0.01 g. Subtract the weight of the jar from the weight of the jar plus contents to get a weight of the contents.

10. Rinse egg shell halves with cool water and allow to dry for 10-30 days. Label each egg shell with the sample number as above in I. A. 3. Store shells in a labeled plastic bag or other container for future thickness measurements.

11. Place a label on the jar, which should be filled out as in item I.C.4 above, and prepare Chain of Custody forms. Freeze samples.

C. Sample transport to contract laboratory

Same as I. D., above.

HUDSON RIVER NATURAL RESOURCE TRUSTEE COUNCIL
WATERFOWL COLLECTION RECORD

Print collector(s) names:
Signature of collector(s):

Method of collection: ____ Collection Area (1, 2, 3 or 4):

Field Lab ID No.	Specimen ID No.	Species	Location (UTM coordinates or attach topo map with location indicated)	Date collected	Sex	Age	Total weight (g)	Notes

Hudson River Natural Resource Trustee Council – Waterfowl 2008
Mallard Egg Processing Data Sheet

Processor(s): Name _____ Name _____

Signature _____ Signature _____

Date Processed: _____

Sample ID: _____

Egg Fresh Weight (g, from the field): _____

Egg Length (three measurements, mm):_____ , _____ , _____ Average _____

Egg Width (three measurements, mm): _____ , _____ , _____ Average _____

Egg Volume (ml): _____

Jar lot number _____ Balance within limits? Yes OR No

Whole Egg Weight (g): _____

Contents weight:

Weight of jar (g) : _____

Weight of jar + contents (g): _____

Weight of contents (g): _____

Membrane location: ___ with embryo OR ___ with eggshell

Contents condition (embryo development [1], state of decay, etc.) and other comments:

_____

_____

Other comments: _____

_____

_____

[1] None, ¼, ½, ¾ , full term

HUDSON RIVER NATURAL RESOURCE TRUSTEE COUNCIL
CHAIN OF CUSTODY

I,_____, of_____collect
(Print Name) (Print Address)
following item(s) on _____, 20 _____from_____
(Date) (Water Body)
in the vicinity of _____
(Wetland, Bay or Cove, Landmark, Village, Road, etc.)

Town of_____, in _____County.

Item(s)_____

_____

Said item(s) were in my possession and handled according to standard procedures provided to me prior to collection. The item(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on_____, 20_____.

_____ _____

FIRST RECIPIENT
I,_____, received the above mentioned same(s) on the date specified and assigned identification number(s) _____to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and dates as attested to below.

_____ _____
Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

NOTICE OF WARRANTY

By signature to the chain of custody (reverse) , the signator warrants that the information provided is truthful and accurate to the best of his/her ability. The signator affirms that he/she is willing to testify to those facts provided and the circumstances surrounding same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signators for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On the day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain specimens in manila tagged plastic bags to avoid mixing . Note appropriate information on each bag tag.

Upon collection, keep samples as cool as possible, preferably on ice. Freeze as soon as possible. If waterfowl are held more than 24 hours without freezing, they will not be retained or analyzed.

The initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, time and date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time and date) in the purpose of transfer block, then is resealed using new tape and rewriting signature, with time and date.

The appropriate completed Waterfowl Collection Record form(s) should be attached to this Chain of Custody form.

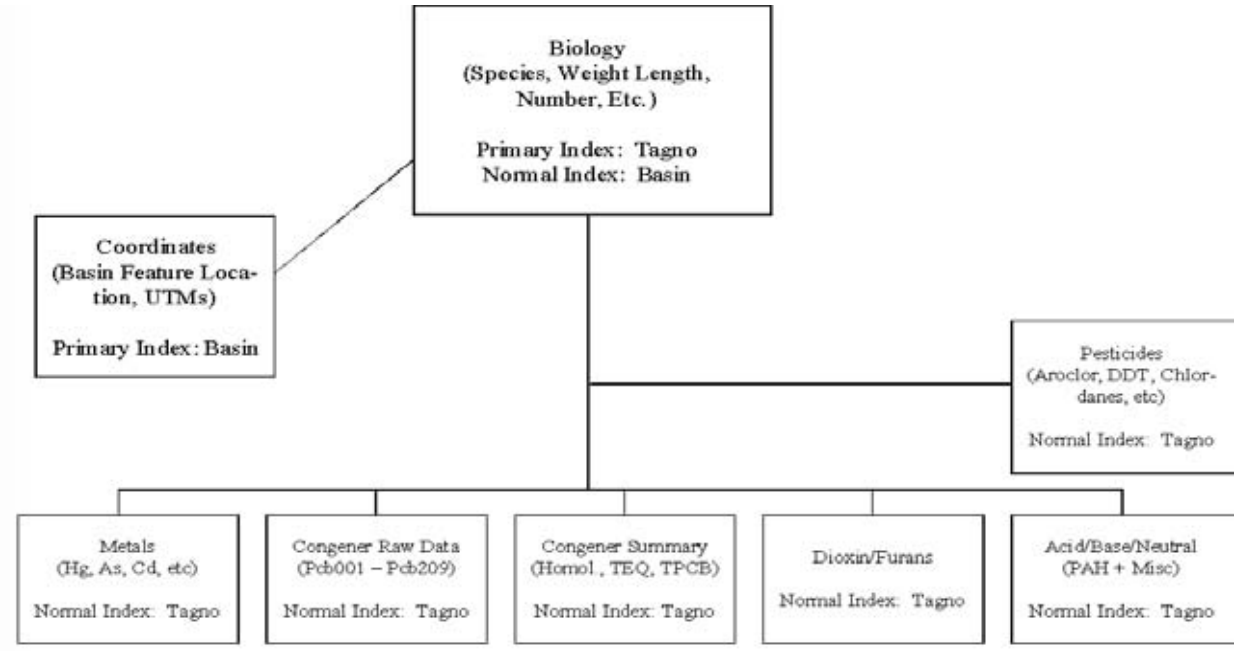
APPENDIX B

DATA DICTIONARY

22 November 2005

DATA DICTIONARY

The purpose of the Data Dictionary is to specify the standardized format for fish/wildlife contaminant data that are to be appended to the master file.



The above figure represents the structure of the contaminant database. Each box represents an individual table. Each table has been designed to store important information regarding biota collection and analysis for the Hudson River, Champlain Basin, Long Island watersheds and Marine waters.

The Bio.dbf file is the master table. All other tables link to this file via the TAGNO or BASIN field. The primary index for Bio.dbf is on TAGNO. A primary index accomplishes two simultaneous tasks. The first is to sort the table based upon the field of choice, allowing for fast retrieval during queries. The second is to guard against duplicate entries within that field. Therefore all TAGNO entries must be kept unique. Duplicate entries will result in an error message from FoxPro.

Table descriptions:

Bio.dbf: Contain physical information relating to the sample (length, species, etc.) Along with a field assigned tag number. A BASIN number is assigned in the Bio file also which links back to Coords.dbf.

Coords.dbf: Stores geographic information related to samples in Bio.dbf. Items such as Feature, Location, Basin Number (unique), River Mile, NYTME, NYTMN, and Area are recorded. River mile refers to the number of miles measured from the southern tip of Manhattan, upstream. There are 9 areas in the Marine district, 5 for New York Harbor and 4 for the Long Island Sound and Atlantic.

Hudorg.dbf: Contains organochlorine analyses, which are linked to Bio.dbf through the TAGNO field. In order to account for the multiple preparations which may be done on a single sample, TAGNO is not a unique field.

Hudmet.dbf: Stores metals analyses, such as Mercury, Lead and Cadmium, among others.

Conraw.dbf Stores congeneric PCB analyses in row order format (due to column limitations).

Consum.dbf: Acts as a summary table for Conraw.dbf. Contains PREP codes, homolog totals and lipid based total PCBs (LPCB).

DioxFur.dbf: Contains Dioxin/DiBenzoFuran analyses

ABN.dbf: ABN is short for Acid/Base/Neutral and contains many water soluble compounds along with polyaromatic hydrocarbons.

A complete description of each of the tables and their associated fields can be found below.

BIOLOGICAL FILE

(Bio.dbf)

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
SDATE	19900628 (YYYYMMDD) Date sample(s) collected	8	0	NUMERIC
TAG NUMBER (TAGNO)	ABC123D7 sampler. No hyphens, spaces, etc.	20		CHARACTER
SPECIES (SPP)	LT, YP, SMB, etc. Species analyzed	7		CHARACTER
NO. ORGANISMS IN ANALYSIS (NOANLY)	48 No. In a single analysis Noanly = 1 for individuals	5	0	NUMBER
BASIN	1234567 Numerical code for basin, sub-basin, location (BBSSLLL)	7	0	NUMERIC
LENGTH (LENMM)	12345.6 Mean total length of fish in millimeters (mm). Length of non-fish species in defined by other than standards specified in the species code data file	7	1	NUMBER

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
MINIMUM LENGTH (MINLEN)	12345.6 Total length of shortest fish in sample - units = mm	7	1	NUMBER
MAXIMUM LENGTH (MAXLEN)	12345.6 Total length of longest fish in sample - units = mm	7	1	NUMBER
STANDARD DEVIATION OF LENGTH (SDLEN)	12345.6 Std. Deviation of total length (mm)	7	1	NUMBER
WEIGHT (WGTG)	12345.6 Mean weight of organisms in grams - units = g	7	1	NUMBER
MINIMUM WEIGHT (MINWGT)	12345.6 Weight of lightest organism in sample - units = g	7	1	NUMBER
MAXIMUM WEIGHT (MAXWGT)	12345.6 Weight of heaviest organism in sample - units = g	7	1	NUMBER
STANDARD DEVIATION OF WEIGHT (SDWGT)	123456.7 Std. Deviation of total weight - units = g	8	1	NUMBER
SEX	M or F Sex of organism	2		CHARACTER
AGE	12 Age of organism in years	4	1	NUMBER
REMARKS	If a tag number is changed in order to comply with singularity of the primary index, then place old tag number here.	100		CHARACTER

COORDINATE FILE

(Coords.dbf)

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
FEATURE	LAKE ONTARIO Lake, river, wetland, site where biota were sampled	15		CHARACTER
LOCATION	Henderson Harbor Geographic description of sample location	55		CHARACTER
BASIN	1234567 Numerical code for basin, sub-basin, location (BBSSLLL)	8	0	NUMERIC
NORTH COORDINATE (NYTMN)	123456789 New York Traverse Mercator Coordinate (Northing)	9	0	NUMERIC
EAST COORDINATE (NYTME)	12345678 New York Traverse Mercator Coordinate (Easting)	8	0	NUMERIC
AREA	1 Refers to marine area in which sample(s) was collected	5	0	NUMERIC
RMILE	142 Hudson river mile as measured from the southern tip of Manhattan. Decimal places are only to distinguish between locations with the same Rmile, and in no way correspond to a geo-spatial reference.	8	1	NUMERIC

ORGANOCHLORINE FILE

(Hudorg.dbf)

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
LAB NUMBER (LABNO)	123M56X2 ID number assigned by laboratory. No hyphens, spaces, etc.	20		CHARACTER
TAG NUMBER (TAGNO)	ABC123D7 sampler. No hyphens, spaces, etc.	20		CHARACTER
SAMPLE PREP (PREP)	SF, WH, KID	10		CHARACTER
LAB	Analyzing laboratory	5		CHARACTER
PERCENT MOISTURE (PCTMOIST)	12.34 Percent moisture of sample	5	2	NUMBER
% LIPID (PCTLPD)	12.34 Percent lipid of sample	5	2	NUMBER
AROCLOR 1016 (AR16)	1234.567 concentration as “Aroclor 1016" units = ppm	8	3	NUMERIC
AROCLOR 1254 (AR54)	1234.567 units = ppm	8	3	NUMERIC
AROCLOR 1254 &1260 (AR5460)	1234.567 units = ppm	8	3	NUMERIC
AROCLOR 1260 (AR60)	1234.567 units = ppm	8	3	NUMERIC
AROCLOR 1221 (AR21)	1234.567 units = ppm	8	3	NUMERIC
AROCLOR 1242 (AR42)	1234.567 units = ppm	8	3	NUMERIC
AROCLOR 1248 (AR48)	1234.567 units = ppm	8	3	NUMERIC
a-HEXACHLORO-CYCLOHEXANE (AHCH) aka a-BHC	12.3.4567 ppm	7	4	NUMERIC
b-HEXACHLORO-CYCLOHEXANE (BHCH) aka b-BHC	12.3456 ppm	7	4	NUMERIC
g-HEXACHLORO-CYCLOHEXANE (GHCH) aka Lindane/ g-BHC	12.3456 ppm	7	4	NUMERIC
d-HEXACHLORO-CYCLOHEXANE (DHCH) aka d-BHC	12.3456 ppm	7	4	NUMERIC

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
P-P’ -DDT (DDT)	12.3456 ppm	8	4	NUMERIC
ortho-para DDT (OPDDT)	12.3456 ppm	8	4	NUMERIC
P-P’ -DDE (DDE)	12.3456 ppm	8	4	NUMERIC
ortho-para DDE (OPDDE)	12.3456 ppm	8	4	NUMERIC
P-P’ - DDD (DDD)	12.3456 ppm	8	4	NUMERIC
ortho-para DDD (OPDDD)	12.3456 ppm	8	4	NUMERIC
cis-CHLORDANE aka alpha chlordane (CISCHL)	12.3456 ppm	7	4	NUMERIC
trans-CHLORDANE aka gamma chlordane (TRANSCHL)	12.3456 ppm	7	4	NUMERIC
OXYCHLORDANE (OXYCHL)	12.3456 ppm	7	4	NUMERIC
METHOXYCHLOR (MEOXYCHL)	12.3456 ppm	7	4	NUMERIC
HEPTACHLOR (HEPTACHL)	12.3456 ppm	7	4	NUMERIC
HEPTACHLOR EPOXIDE (HEPCLEPX)	12.3456 ppm	7	4	NUMERIC
MIREX	12.3456 ppm	7	4	NUMERIC
PHOTOMIREX (PHOMIREX)	12.3456 ppm	7	4	NUMERIC
TOXAPHENE (TOXAPH)	12.3456 ppm	7	4	NUMERIC
TRANSNONACHLOR aka alpha nonachlor (TRANSNON)	12.3456 ppm	7	4	NUMERIC
CISNONACHLOR aka beta nonachlor (CISNON)	12.3456 ppm	7	4	NUMERIC

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
OCTACHLORO-STYRENE (OCTACLST)	12.3456 ppm	7	4	NUMERIC
ENDRIN	12.3456 ppm	7	4	NUMERIC
ENDRIN ALDEHYDE (ENDRINAL)	12.3456 ppm	7	4	NUMERIC
ENDOSULFAN I (ENDOSUL1)	12.3456 ppm	7	4	NUMERIC
ENDOSULFAN II (ENDOSUL2)	12.3456 ppm	7	4	NUMERIC
ENDOSULFAN SULFATE (ENDOSATE)	12.3456 ppm	7	4	NUMERIC
DIELDRIN	12.3456 ppm	7	4	NUMERIC
ALDRIN	12.3456 ppm	7	4	NUMERIC
HEXACHLORO - BENZENE (HCB)	12.3456 ppm	7	4	NUMERIC
a-CHLORDENE (ACHLOR)	12.3456 ppm	7	4	NUMERIC
b-CHLORDENE (BCHLOR)	12.3456 ppm	7	4	NUMERIC
g-CHLORDENE aka Compound E (GCHLOR)	12.3456 ppm	7	4	NUMERIC
TOTAL PCB (TPCB)	1234.567 Total of all “Aroclor” ppm	8	3	NUMERIC
LIPID NORMALIZED PCB (LPCB)	1234.567 Lipid normalized of Total “Aroclor” ppm	8	3	NUMERIC
SIMPLE TOTAL PCB (STPCB)	1234.567 Total PCB shown in data where no “Aroclor” nor congener data was supplied by the provider.	8	3	NUMERIC
TOTAL DDT (TDDT)	123.4567 Total of DDD, DDE, DDT, OPDDD, OPDDE & OPDDT units = ppm	8	4	NUMERIC
TOTAL CHLORDANE (TCHL)	Total of cis & trans chlordanes + oxychlordane + cis & transnonachlors	7	4	NUMERIC
TOTAL HCH (THCH)	Total of AHCH, BHCH, GHCH & DHCH units = ppm	7	4	NUMERIC

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
TOTAL MIREX (TMIREX)	Total of mirex and photomirex units = ppm	7	4	NUMERIC
TOTAL DIELDRIN (TDLDRN)	total of dieldrin + aldrin units = ppm	7	4	NUMERIC
FILENAME	Name of DEC file from which data were appended	8		CHARACTER

RAW PCB CONGENER FILE

(Conraw.dbf)

The Conraw file is a bit different from other files in the data set. While other files are in column major order, Conraw is in row major order. Column major order is a common tabular format in which one sample (in our case biota) uses only one record in the data set. Row major order uses a variable number of records in the data set equal to the number of analyses performed on that sample. To view the differences, one may compare Consum.dbf (column major order) with Conraw (row major order).

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
LAB NUMBER (LABNO)	123M56X2 ID number assigned by laboratory. No hyphens, spaces, etc.	20		CHARACTER
TAG NUMBER (TAGNO)	ABC123D7 sampler. No hyphens, spaces, etc.	20		CHARACTER
CONGENER PCB NUMBER (CHEMCODE)	monoelute = P### coelute = P###### where the two PCB numbers are combined into a single 6 digit number (P004 + P010 = P004010)	10	3	NUMERIC
CONCENTRATION (CONCEN)	12345.678 (ppb)	10	3	NUMERIC

SUMMARY CONGENER FILE

(Consum.dbf)

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
SAMPLE PREP (PREP)	SF, WH, KID	10		CHARACTER
LAB	Analyzing laboratory	5		CHARACTER
LAB NUMBER (LABNO)	123M56X2 ID number assigned by laboratory. No hyphens, spaces, etc.	20		CHARACTER
TAG NUMBER (TAGNO)	ABC123D7 sampler. No hyphens, spaces, etc.	20		CHARACTER
COLUMN	DB1 Capillary column used for analyses	6		CHARACTER
MONOPCB	123456.7890 (ppb)	11	4	NUMERIC
DIPCB	123456.7890 (ppb)	11	4	NUMERIC
TRIPCB	123456.7890 (ppb)	11	4	NUMERIC
TETRAPCB	123456.7890 (ppb)	11	4	NUMERIC

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
PENTAPCB	123456.7890 (ppb)	11	4	NUMERIC
HEXAPCB	123456.7890 (ppb)	11	4	NUMERIC
HEPTAPCB	123456.7890 (ppb)	11	4	NUMERIC
OCTAPCB	123456.7890 (ppb)	11	4	NUMERIC
NONAPCB	123456.7890 (ppb)	11	4	NUMERIC
DECAPCB	123456.7890 (ppb)	11	4	NUMERIC
TOTAL PCB (TPCB)	123456789.01 (ppb) Total PCB as calculated from individual congeners	12	2	NUMERIC
TOTAL LIPID PCB (LPCB)	1234567890123456.789 Lipid normalized of Total “Congener” ppm	20	3	NUMERIC
PCTMOIST	12.34 Percent moisture measured by the lab	5	2	NUMERIC
PCTLPD	12.34 Percent lipid measured by the lab	5	2	NUMERIC
FILENAME	Name of DEC file from which data were appended	8		CHARACTER
REMARKS	If a tag number is changed in order to comply with singularity of the primary index, then place old tag number here.	100		CHARACTER
NO_PEAKS	123 (ppb) Total number of peaks analyzed in a particular analysis	3	0	NUMERIC

METALS FILE

(Hudmet.dbf)

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
SAMPLE PREP (PREP)	SF, WH, KID	10		CHARACTER
LAB	Analyzing laboratory	5		CHARACTER
LAB NUMBER (LABNO)	123M56X2 ID number assigned by laboratory. No hyphens, spaces, etc.	20		CHARACTER
TAG NUMBER (TAGNO)	ABC123D7 sampler. No hyphens, spaces, etc.	20		CHARACTER
PCTMOIST	123.45 Percent moisture measured by the lab	5	2	NUMERIC
PCTLPD	123.45 Percent lipid measured by the lab	5	2	NUMERIC
FILENAME	Name of DEC file from which data were appended	8		CHARACTER

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
REMARKS	If a tag number is changed in order to comply with singularity of the primary index, then place old tag number here.	100		CHARACTER
MERCURY (HG)	1234.56 ppm	8	4	NUMERIC
ORGANIC MERCURY (ORGHG)	1234.56 ppm	6	2	NUMERIC
INORGANIC MERCURY (INORGHG)	1234.56 ppm	6	2	NUMERIC
LEAD (PB)	1234.56 ppm	6	2	NUMERIC
CADMIUM (CD)	1234.56789 ppm	9	5	NUMERIC
COBALT (CO)	1234.56 ppm	6	2	NUMERIC
VANADIUM (VN)	1234.56 ppm	6	2	NUMERIC
ARSENIC (AS)	1234.56 ppm	6	2	NUMERIC
SELENIUM (SE)	1234.56 ppm	6	2	NUMERIC
ZINC (ZN)	1234.56 ppm	6	2	NUMERIC
CHROMIUM (CR)	1234.56 ppm	6	2	NUMERIC
SILVER (AG)	1234.56 ppm	6	2	NUMERIC
COPPER (CU)	1234.56 ppm	6	2	NUMERIC
STRONTIUM (SR)	1234.56 ppm	6	2	NUMERIC
NICKEL (NI)	1234.56 ppm	6	2	NUMERIC

DIOXIN/FURAN FILE

(Dioxfur.dbf)

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
SAMPLE PREP (PREP)	SF, WH, KID	10		CHARACTER
LAB	Analyzing laboratory	5		CHARACTER
LAB NUMBER (LABNO)	123M56X2 ID number assigned by laboratory. No hyphens, spaces, etc.	20		CHARACTER
TAG NUMBER (TAGNO)	ABC123D7 sampler. No hyphens, spaces, etc.	20		CHARACTER
PCTMOIST	123.45 Percent moisture measured by the lab	5	2	NUMERIC
PCTLPD	123.45 Percent lipid measured by the lab	5	2	NUMERIC
FILENAME	Name of DEC file from which data were appended	8		CHARACTER
REMARKS	If a tag number is changed in order to comply with singularity of the primary index, then place old tag number here.	100		CHARACTER
2,3,7,8-TETRA-CHLORODIBENZO-DIOXIN (CDD2378)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
1,2,3,7,8-PENTA-CHLORODIBENZO-DIOXIN (CDD12378)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
1,2,3,6,7,8-HEXACHLORO-DIBENZODIOXIN (CDD123678)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
1,2,3,7,8,9-HEXACHLORO-DIBENZODIOXIN (CDD123789)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
1,2,3,4,7,8-HEXACHLORO-DIBENZODIOXIN (CDD123478)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
1,2,3,4,6,7,8-HEPTACHLORO-DIBENZODIOXIN (CDD1234678)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
OCTACHLORO-DIBENZODIOXIN (OCDD)	12345.678 parts per trillion (ppt)	8	3	NUMERIC

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
2,3,6,7-TETRACHLORO-DIBENZOFURAN (CDF2367)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
2,3,7,8-TETRACHLORO-DIBENZOFURAN (CDF2378)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
3,4,6,7-TETRACHLORO-DIBENZOFURAN (CDF3467)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
1,2,3,7,8-PENTACHLORO-DIBENZOFURAN (CDF12378)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
2,3,4,6,7-PENTACHLORO-DIBENZOFURAN (CDF23467)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
2,3,4,7,8-PENTACHLORO-DIBENZOFURAN (CDF23478)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
1,2,3,4,7,8-HEXACHLORO-DIBENZOFURAN (CDF123478)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
1,2,3,4,6,7-HEXACHLORO-DIBENZOFURAN (CDF123467)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
1,2,3,6,7,8-HEXACHLORO-DIBENZOFURAN (CDF123678)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
2,3,4,6,7,8-HEXACHLORO-DIBENZOFURAN (CDF234678)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
1,2,3,7,8,9-HEXACHLORO-DIBENZOFURAN (CDF1,2,3,7,8,9)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
1,2,3,4,6,7,8-HEPTACHLORO-DIBENZOFURAN (CDF1234678)	12345.678 parts per trillion (ppt)	8	3	NUMERIC

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
1,2,3,47,8,9-HEPTACHLORO-DIBENZOFURAN (CDF1234789)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
OCTACHLORO-DIBENZOFURAN (OCDF)	12345.678 parts per trillion (ppt)	8	3	NUMERIC
TTCD	Total Tetrachloro-dibenzodioxins in ppt	8	3	NUMERIC
TPCD	Total Pentachloro-dibenzodioxins in ppt	8	3	NUMERIC
THCD	HCDD4+HCDD6+ HCDD7 concentration in ppt	8	3	NUMERIC
THPCDD	Total Heptachloro-dibenzodioxins in ppt	8	3	NUMERIC
TTCDF	Total Tetrachloro-dibenzofurans in ppt	8	3	NUMERIC
TPCDF	PCDF1+PCDF4 in ppt	8	3	NUMERIC
THCDF	HCDF14+HCDF16+HCDF19+HCDF46 in ppt	8	3	NUMERIC
THPCDF	HPCDF6+HPCDF9 in ppt	8	3	NUMERIC

ACID/BASE NEUTRAL FILE

(ABN.dbf)

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
SAMPLE PREP (PREP)	SF, WH, KID	10		CHARACTER
LAB	Analyzing laboratory	5		CHARACTER
LAB NUMBER (LABNO)	123M56X2 ID number assigned by laboratory. No hyphens, spaces, etc.	20		CHARACTER
TAG NUMBER (TAGNO)	ABC123D7 sampler. No hyphens, spaces, etc.	20		CHARACTER
PCTMOIST	123.45 Percent moisture measured by the lab	5	2	NUMERIC
PCTLPD	123.45 Percent lipid measured by the lab	5	2	NUMERIC
FILENAME	Name of DEC file from which data were appended	8		CHARACTER
REMARKS	If a tag number is changed in order to comply with singularity of the primary index, then place old tag number here.	100		CHARACTER
BIPHENYL	12345.67 ppb	8	3	NUMERIC
DICOFOL	12345.67 ppb	8	3	NUMERIC
Trifluralin (triflu)	12345.67 ppb	8	3	NUMERIC
Isopropalin (ISOPRO)	12345.67 ppb	8	3	NUMERIC
PERTHANE	12345.67 ppb	8	3	NUMERIC
PHENOl	12345.67 ppb	8	3	NUMERIC
Chlorbenzilate (CLBENATE)	12345.67 ppb	8	3	NUMERIC
BIS(-2-CHLORO-ETHYL) ETHER (BIS2CLET)	12345.67 ppb	8	3	NUMERIC
2-CHLOROPHENOL (CLPH2)	12345.67 ppb	8	3	NUMERIC
1,3-DICHLORO-BENZENE (DCLB13)	12345.67 ppb	8	3	NUMERIC

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
1,4-DICHLORO-BENZENE (DCLB14)	12345.67 ppb	8	3	NUMERIC
BENZYL ALCOHOL (BENZALC)	12345.67 ppb	8	3	NUMERIC
1,2-DICHLORO-BENZENE (DCLB12)	12345.67 ppb	8	3	NUMERIC
2-METHYLPHENOL (MEPH2)	12345.67 ppb	8	3	NUMERIC
BIS(2-CHLORO-ISOPROPYL) ETHER (B2CLISOE)	12345.67 ppb	8	3	NUMERIC
4-METHYLPHENOL (MEPH4)	12345.67 ppb	8	3	NUMERIC
N-NITROSO-DI-N-PROPYLAMINE (NITNPRAM)	12345.67 ppb	8	3	NUMERIC
HEXACHLORO-ETHANE (HEXCLETE)	12345.67 ppb	8	3	NUMERIC
NITROBENZENE (NITBEN)	12345.67 ppb	8	3	NUMERIC
ISOPHORONE (ISOPHO)	12345.67 ppb	8	3	NUMERIC
2-NITROPHENOL (NITPH2)	12345.67 ppb	8	3	NUMERIC
2,4-DIMETHYL-PHENOL (DIMEPH24)	12345.67 ppb	8	3	NUMERIC
BENZOIC ACID (BENACID)	12345.67 ppb	8	3	NUMERIC
BIS(2-CHLORO-ETHOXY) METHANE (BIS2CLME)	12345.67 ppb	8	3	NUMERIC
2,4-DICHLORO-PHENOL (DICHLPH24)	12345.67 ppb	8	3	NUMERIC
1,2,4-TRICHLORO-BENZENE (TRICLB124)	12345.67 ppb	8	3	NUMERIC
1,2,5-TRICHLORO-BENZENE (TRICLB125)	12345.67 ppb	8	3	NUMERIC

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
1,2,3-TRICHLORO-BENZENE (TRICLB123)	12345.67 ppb	8	3	NUMERIC
NAPHTHALENE (NAPH)	12345.67 ppb	8	3	NUMERIC
4-CHLOROANILINE (CLANIL4)	12345.67 ppb	8	3	NUMERIC
HEXACHLORO-BUTADIENE (HEXCLBUT)	12345.67 ppb	8	3	NUMERIC
4-CHLORO-3-METHYLPHENOL (CL4ME3PH)	12345.67 ppb	8	3	NUMERIC
1-METHYLNAPH-THALENE (MENAPH1)	12345.67 ppb	8	3	NUMERIC
1-METHYLNAPH-THALENE (MENAPH1)	12345.67 ppb	8	3	NUMERIC
2-METHYLNAPH-THALENE (MENAPH2)	12345.67 ppb	8	3	NUMERIC
HEXACHLORO-CYCLOPENTADIENE (HEXCLCYP)	12345.67 ppb	8	3	NUMERIC
2,4,6-TRI-CHLOROPHENOL (TCLPH246)	12345.67 ppb	8	3	NUMERIC
2,4,5-TRI-CHLOROPHENOL (TCLPH245)	12345.67 ppb	8	3	NUMERIC
2-CHLORO-NAPTHALENE (CLNAPH2)	12345.67 ppb	8	3	NUMERIC
2-NITROANILINE (NITANIL2)	12345.67 ppb	8	3	NUMERIC
DIMETHYL PHTHALATE (DIMEPHTH)	12345.67 ppb	8	3	NUMERIC
ACENAPHTHYLENE (ACNAPHY)	12345.67 ppb	8	3	NUMERIC
2,6 DINITRO-TOLUENE (DINTOL26)	12345.67 ppb	8	3	NUMERIC

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
3-NITROANILINE (NIANIL3)	12345.67 ppb	8	3	NUMERIC
ACENAPHTHENE (ACNAPH)	12345.67 ppb	8	3	NUMERIC
NITROPHEN	12345.67 ppb	8	3	NUMERIC
2,4-DINI-TROPHENOL (DINIPH24)	12345.67 ppb	8	3	NUMERIC
4-NITROPHENOL (NIPH4)	12345.67 ppb	8	3	NUMERIC
DIBENZOFURAN (DIBFURAN)	12345.67 ppb	8	3	NUMERIC
2,4-DINI-TROTOLUENE (DNITOL24)	12345.67 ppb	8	3	NUMERIC
DIETHYL-PHTHALATE (DIETHPHT)	12345.67 ppb	8	3	NUMERIC
4-CHLOROPHENYL-PHENYLETHER (CLPH4ETH)	12345.67 ppb	8	3	NUMERIC
FLUORENE (FL)	12345.67 ppb	8	3	NUMERIC
4-NITROANILINE (NITANIL4)	12345.67 ppb	8	3	NUMERIC
4,6-DINITRO-2-METHYLPHENOL (DINMEPH)	12345.67 ppb	8	3	NUMERIC
N-NITROSODI-PHENYLAMINE*(l) (DIPHAM)	12345.67 ppb	8	3	NUMERIC
4-BROMOPHENYL-PHENYLETHER (BRPH4ETH)	12345.67 ppb	8	3	NUMERIC
PENTACHLORO-PHENOL (PENCLPH)	12345.67 ppb	8	3	NUMERIC
PHENANTHRENE (PHENAN)	12345.67 ppb	8	3	NUMERIC
ANTHRACENE (ANTHRA)	12345.67 ppb	8	3	NUMERIC

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
DI-N-BUTYL-PHTHALATE (BUTPHTH)	12345.67 ppb	8	3	NUMERIC
FLUORANTHENE (FLANTH)	12345.67 ppb	8	3	NUMERIC
PYRENE	12345.67 ppb	8	3	NUMERIC
BUTYLBENZYL-PHTHALATE (BUBENPHT)	12345.67 ppb	8	3	NUMERIC
3,31-DICHLORO-BENZIDINE (DICBEN33)	12345.67 ppb	8	3	NUMERIC
BENZO(A)-ANTHRACENE (BENANTH)	12345.67 ppb	8	3	NUMERIC
CHRYSENE	12345.67 ppb	8	3	NUMERIC
BIS(2-ETHYL-HEXYL)PHTHALATE (BI2ETHPH)	12345.67 ppb	8	3	NUMERIC
DI-N-OCTYL PHTHALATE (DINOCPHT)	12345.67 ppb	8	3	NUMERIC
DENZO(B)-FLUORANTHENE (BENBFLAN)	12345.67 ppb	8	3	NUMERIC
BENZO(K)-FLUORANTHENE (IBENKFLAN)	12345.67 ppb	8	3	NUMERIC
BENZO(A)PYRENE (BENAPYR)	12345.67 ppb	8	3	NUMERIC
INDENO-(1,2,3-CD)PYRENE (IND123PPY)	12345.67 ppb	8	3	NUMERIC
DIBENZO(A,H)-ANTHRACENE (DIBENANT)	12345.67 ppb	8	3	NUMERIC
IBENZO(G,H,I) PERYLENE (BENGHIPE)	12345.67 ppb	8	3	NUMERIC
2-Picoline (PICOLINE)	12345.67 ppb	8	3	NUMERIC

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
N-Nitroso-dimethylamine (NITAMINE)	12345.67 ppb	8	3	NUMERIC
Methyl Methane-sulfonate (METHSULF)	12345.67 ppb	8	3	NUMERIC
Ethyl Methane-Sulfonate (ETHYSULF)	12345.67 ppb	8	3	NUMERIC
Pentachloroanisole (PCA)	12345.67 ppb	8	3	NUMERIC
ANILINE	12345.67 ppb	8	3	NUMERIC
1-Nitroso-piperidine (NILPIPDN)	12345.67 ppb	8	3	NUMERIC
4,3-Methyl-phenol (ME43PHEN)	12345.67 ppb	8	3	NUMERIC
7,12-Dimethyl-bez(a)anthracene (DIMEANTH)	12345.67 ppb	8	3	NUMERIC
2,6-Dichloro-phenol (DI26PHEN)	12345.67 ppb	8	3	NUMERIC
N-Nitroso-dibutylamine (NIBUTYAM)	12345.67 ppb	8	3	NUMERIC
1,2,3,5-Tetra chlorobenzene (TCB1235)	12345.67 ppb	8	3	NUMERIC
1,2,3,4-Tetra chlorobenzene (TCB1234)	12345.67 ppb	8	3	NUMERIC
1,2,4,5-Tetra-chlorobenzene (TCB1245)	12345.67 ppb	8	3	NUMERIC
Diphenyl Disulfide (DPDS)	12345.67 ppb	8	3	NUMERIC
Diphenyl-hydrazine (DPHYDRAZ)	12345.67 ppb	8	3	NUMERIC
2,3,4,6-Tetra-chlorophenol (TET2346)	12345.67 ppb	8	3	NUMERIC

Field Name (mnemonic)	Example/Remarks	Field Width	Decimal	Type
1-Naphthylamine (NAPLAMINE)	12345.67 ppb	8	3	NUMERIC
Pentachlorobenzene (PENTABEN)	12345.67 ppb	8	3	NUMERIC
Azobenzene (AZOBENZN)	12345.67 ppb	8	3	NUMERIC
Phenacetin (PHACETIN)	12345.67 ppb	8	3	NUMERIC
Pronamide (PRONAMID)	12345.67 ppb	8	3	NUMERIC
4-Aminobiphenyl (AM4BIPHEN)	12345.67 ppb	8	3	NUMERIC
Pentachloro-nitrobenzene (PENNITBENZ)	12345.67 ppb	8	3	NUMERIC
Benzidine (BENZDIN)	12345.67 ppb	8	3	NUMERIC
P-Dimethyl-aminoazobenzene (PDIMAMAZ)	12345.67 ppb	8	3	NUMERIC
Bis(2-Ethyl-hexyl)Phthalate (BIS2ETHPH)	12345.67 ppb	8	3	NUMERIC
3-Methyl-chloranthrene (ME 3 CLANTHR)	12345.67 ppb	8	3	NUMERIC
Chlorpyrifos (CPYRF)	12345.67 ppb	8	3	NUMERIC
Endrin Ketone (Endrket)	12345.67 ppb	8	3	NUMERIC
Dibenz(a,i)- 1 acridine (DIBACRID)	12345.67 ppb	8	3	NUMERIC

APPENDIX C

STANDARD OPERATING PROCEDURES FOR COLLECTION AND SAMPLING OF WILDLIFE WITH FIREARMS

DIVISION OF FISH, WILDLIFE AND MARINE RESOURCES

STANDARD OPERATING PROCEDURES (SOP #24)

FOR

COLLECTION AND SAMPLING OF WILDLIFE WITH FIREARMS

CONTENTS

I. Purpose:

The purpose of this Standard Operating Procedure (SOP) is to describe the training, information, and equipment necessary to protect the health and safety of division employees and the public in situations requiring department authorized collection of wildlife with firearms. Division of Fish, Wildlife & Marine Resources (DFWMR) employees, particularly within the Bureau of Wildlife are sometimes required to remove wildlife as a part of their assigned duties. Situations involving firearm collection can vary widely, from euthanasia of a single distressed or diseased animal, to removal of multiple animals as part of a control program, scientific study, or disease investigation. In all cases, public and employee safety is the number one priority. This SOP outlines prerequisite safety training requirements for employees, field operation protocols, and provides for specialized firearm wildlife collection training to maintain a high level of employee/public safety.

While human safety is the foremost concern associated with the use of firearms, there is also a public expectation that wildlife euthanized for any purpose, in any fashion, be accomplished in a humane, efficient manner. To that end, the Bureau of Wildlife has previously developed recommendations for firearm euthanasia for several species under specific circumstances (e.g., Best Practices for Nuisance Wildlife Control Operators, 2004 and New York State Black Bear Response Manual, 2006).The guidance provided in this SOP, together with requirements for requisite training is intended to further ensure that any wildlife taken by DFWMR staff, for any purpose, be done humanely, safely, and effectively.

II. General Firearm Procedures and Protocols:

Because firearms have a potential for misuse by untrained or unauthorized use, the care, storage, transportation and use of these tools needs to be well defined. Department policy provides basic oversight on the use of "Firearms and other Dangerous Weapons" and specifies that use by Wildlife or Sportsmen's Education personnel be in accordance with assigned duties. See the Department's Administrative Policy OAD-16 (http://internal/home/qma/policy/OAD16.html) for more information.

In addition to internal policy, the following requirements will be followed by DFWMR staff in the use, transportation, and storage of state assigned firearms.

1. No employee otherwise limited by law will be assigned duties involving the use of firearms.
2. Firearms not in use will be stored in a secure locked gun safe.
3. A trigger or breech lock that prevents firing will be used for temporary storage, such as during a multi-day detail.
4. When in transport to use in the field, firearms used by DFWMR employees shall be cased. If it is necessary for a firearm to be left in an un-attended vehicle temporarily, the vehicle must be locked, and the firearm stored out of sight.
5. When using firearms as a part of assigned duties, DFWMR employees shall be readily identifiable as a state official. State vehicles with department logo affixed should be used, and suitable clothing with Department/DFWMR identification should be worn.

III. Basic Firearm Safety Training:

Employees handling and using firearms as a part of their assigned duties must be adequately trained to use these tools in a safe, humane, and efficient manner. To meet these requirements, DFWMR staff who use firearms will be trained in basic firearm safety and use. Such training will be conducted by either regional law enforcement or the regional sportsmen's education coordinator in consultation with the regional Division of Law Enforcement (DLE) captain. The basic firearm safety training course is outlined in Appendix I. Components of the training will include safe handling/shooting instruction, rifle/shotgun design, ballistic characteristics, safe firearm handling simulation, personal protective equipment and personal safety, loading and unloading exercises, care and cleaning, and range firing. In addition, basic firearm safety training

will include instruction on identifying whether collection by firearm is suited to the purpose, or if other techniques (e.g., traps, catch poles, or nets) are more appropriate. Upon completion of the training, a list of qualified individuals will be maintained by the appropriate regional wildlife manager (supervisors of Central Office employees will be provided documentation for any non-regionalized staff completing the training). Employees will be encouraged to take additional training from qualified sources to maintain proficiency and improve skills. In addition, annual range "re-certification" will be required for each employee. Re-certification will include safe handling, loading/unloading and a live fire exercise administered by either DLE or the regional sportsmen's education coordinator.

IV. Specialized Firearm Collection of Wildlife

Any employee assigned to free ranging wildlife collection will receive appropriate situation training specific to the nature of the collection effort. Free ranging wildlife collection may necessarily take place on the open landscape during daylight, night-time, or over open waters. Because there is less control over the shooting environment in these situations, prerequisite specialized training will include instruction and field simulation exercises tailored to actual field conditions. Since field scenarios involve a variety of factors that must be considered in determining whether an individual is capable of making a shot with required precision with near certainty, (such as firearm and ammunition selection, distance to target, availability of a rest or support, marksmanship skills, angle of presentation, vegetation or other obstructions, target behavior and speed) training will emphasize consideration of these factors and the importance of good judgment in determining whether a shot should be attempted or not, and will not test marksmanship *per se*. Appendix II contains a detailed outline of the specific training required for collection of free ranging wildlife.

V. Protocols for Sampling, Collection, and Removal of Wildlife:

The following several scenarios describe situations in which a DFWMR employee may be acting to collect, sample or remove wildlife.

A. Emergency Response- Single Animal

An emergency response includes situations in which human health or safety may be in danger if prompt removal of an animal does not occur. Most often, a law enforcement agency will be the first responder, and the likely entity to destroy the animal. In some circumstances however, law enforcement may be unavailable, or may not be comfortable in taking the animal due to a lack of familiarity with the species or proper shot placement. In these situations Bureau of Wildlife staff and other trained DFWMR staff may be required to remove the animal. Removal of such animals will be limited to qualified employees who have completed either Basic Firearm Safety Training or Specialized Collection of Wildlife Training.

B. Captive

Captive wildlife includes animals contained in fences, cages, or otherwise restrained from free movement in the wild. Often, but not always, these animals are possessed illegally. To minimize potential liability associated with private property claims, field personnel should thoroughly describe the specifics of each case for consideration by appropriate policy makers in the regional office. In some cases, it may also be necessary to consult with central office personnel. In cases that clearly have legal implications, both the Division of Law Enforcement and the Department's Office of General Counsel, via the regional attorney, should be consulted before taking further action. Removal of such animals is sometimes necessary to protect human health and safety, prevent spread of wildlife disease, or to euthanize a sick or injured animal. Because there are often strong human emotions involved with taking wildlife in someone's possession, alternative methods should first be considered. Removal options include traps, nets, catch poles, and chemical immobilization. These techniques allow for non-lethal removal from a premise in a way that may be viewed as more acceptable than lethal take on site. Unfortunately, non-lethal capture and removal is not practical in every situation. Animals held in large enclosures or that are otherwise wary can often avoid capture attempts, requiring the range afforded by a firearm for efficient taking. In these circumstances, removal with a firearm is appropriate by members of the Bureau of Wildlife that have completed Basic Firearm Safety Training. When lethal control is used, or when the forcible removal of an animal is required from private premises, the Division of Law Enforcement must be present during all phases of these operations.

C. Free Ranging

Applies to situations in which single or multiple animals will be collected as part of routine or special circumstances. Example include: collections as part of scientific study, disease control, or monitoring, and population control programs. These typically involve healthy animals on the landscape, or in special circumstances, diseased animals in a free ranging state. Minimum qualifications are basic safety training and completion of specialized instruction which includes training specific to the scenarios in subsections 1-3 below.

1. Daylight Operations

These situations may include collection of apparently healthy, free ranging wildlife for control purposes, contaminant study, and disease monitoring or scientific research. In addition to the basic considerations of staff/public safety, and proper firearm selection and handling, the collector needs to be prepared to operate under conditions that cannot always be controlled. In field situations, distance to target, terrain, weather, and other factors can influence when and if an animal should be collected. Because of these factors, a shooting team of a minimum of two staff is normally recommended, with one designated as the spotter and the other as shooter. The role of the spotter is to ensure safe and effective collection can take place through assessment of downrange conditions, distance to target and other circumstances which might dictate the decision to shoot or not. The shooter and the spotter must be in agreement that a safe and effective shot is presented before shooting. Additionally the shooter needs to have adequate

knowledge of the effective range of the firearm in use, and possess the required proficiency to be successful. Required equipment for the shooting team includes appropriate hearing and eye protection, and suitable clothing for conditions. In addition, where distance or visibility and terrain features indicate, they should also be equipped with binoculars, spotting scope or rangefinder.

2. Night Operations

Many species of wildlife can be more effectively taken during the evening hours than during daylight due to their natural activity patterns. Night-time shooting (or in low light conditions) requires additional considerations and equipment to ensure safety and efficiency are not compromised. Wildlife collection after dark should normally be done by a shooting team of at least two persons with duties as described for daylight operations. Pre-scouting of shooting locations during daylight is a desired prerequisite to determine safe zones of fire, and any potential hazards/obstacles which may not be apparent in the dark. Each shooting team needs to be equipped with a hand-held spotlight. In addition, Forward Looking Infra-Red (FLIR) or Generation II (or higher) night vision optics to identify target animals is highly recommended. These devices are also very useful in confirming the absence of downrange hazards and for this reason they should be used whenever practical. Use of FLIR or Gen II technology is a critical component of the Specialized Collection of Wildlife training. Each member of the team will be familiar with these devices prior to going afield.

3. Water

Taking wildlife on or over water; or shooting such that a bullet passes over water, requires consideration of maximum downrange safe zones. The potential for ricochet off the water surface, combined with a lack of obstructions to intercept a bullet amplify downrange safety concerns. Generally, the safe downrange distance beyond a target animal should be considered to be equivalent to the maximum range of the bullet/caliber being used. Unless conditions dictate otherwise, short range projectiles should be used. Most wildlife collection over water requires a shooting team of two or more people consisting of shooter and spotter(s). Because boat traffic, both motorized and non-motorized, can enter downrange areas from any direction, the role of the spotter becomes even more important than in land based shooting. Wildlife collection over water requires constant communication between spotter and shooter to ensure extended downrange safety is maintained, and safe zones of fire are not encroached. The two person team requirement may be dropped when shooting on/over small waterbodies in remote locations, where bullet ricochet would not be a problem. The two person team is also not required when shotguns (used with shot), and not rifles, are being used.

VI. Consistency With Other Environmental Conservation Laws:

Collection of wildlife for research, management and control (ECL Article 11, Title 5) is ethically and legally distinct from hunting wildlife (ECL Article 11, Title 9). Environmental Conservation law limitations placed on hunting to ensure the ethical concept of fair chase do not apply to collection of wildlife by DFWMR staff. As such, there are instances where carrying a loaded firearm in a vehicle, including boats, shooting from a vehicle, baiting, and utilization of ECL

prohibited technological advantages (i.e., electronic calls) may be allowed after consultation with the Regional Wildlife Manager and DLE staff. However, procedures and considerations for the ethical and humane disposition of animals will remain in place.

Appendix I
Basic Firearms Safety for DFWMR Employees

All DFWMR employees assigned to use firearms during the course of wildlife management activities will be trained in their safe use and operation. A basic training course consisting of 4 hours of instruction is required. The course shall consist of 2 hours of classroom instruction and 2 hours of range instruction. Annual range re-certification will be required to maintain qualification.

Classroom:
The following topics shall be taught: basic firearm safety rules, firearm handling, firearm design, calibers, ballistics, trajectory, safe zone of fire, and appropriate firearm selection for various species and situations. In addition, firearm cleaning, care and storage will be discussed. Classroom discussion will emphasize the importance of ethics, public relations, and professional conduct as a representative of the Department.

Range:
Range session will include firearm inspection (loaded vs. unloaded), safe handling and carrying exercises, loading and unloading, and range shooting.

Appendix II
Specialized Firearm Collection and Sampling of Wildlife- Training Outline

CLASSROOM

10:00a.m. - General considerations:

Need or Purpose for Collection (20 minutes)
Segment to cover the range of possible scenarios in which wildlife collection may occur. For specialized collections there is often lead time prior to implementation. Among other topics, the need for pre-planning, proper equipment selection and documentation of activities will be stressed. Classroom discussion will emphasize the importance of ethics, public relations, and professional conduct as a representative of the Department.

Shot Placement and Purpose (30 minutes)
Depending on the purpose of the collection effort, shot placement can be critical. While a single, humane, killing shot is always the goal, often there is a need to preserve specific tissues or organs. This segment will address best shot placement relative to humane interests and the specific collection purpose.

Safety- Employee SOPs and Best Practices (30 minutes)
Segment to include: firearm cardinal rules, safe handling, and required/recommended PPE (hearing, eye, etc). This portion of course will be a refresher, intended to build on instruction provided in the Basic Firearm Safety training required as a pre-requisite. In addition, storage requirements will be reviewed.

Safety- Public (40 minutes)
Segment will cover understanding ballistics, zones of fire, recognition of site features which could influence public safety, and safe shot decision-making. Key purpose will be to provide a solid basis for assessing a site for safe firearm use.

12:00p.m. - Lunch

1:00p.m. - Gearing Up:

Firearms (suited to species), including ammunition selection (20 minutes)
Segment will focus on selection of best rifle or shotgun for the task. Emphasis will be on knowing the purpose of the collection, likely site characteristics, suitability of various calibers (gauges/chokes) at various ranges for individual species, and best ammunition and bullet choices for safety and efficiency.

Daytime Operations (30 minutes)
Segment will serve as an introduction to daytime collection of free ranging wildlife. This is the portion of the course which begins to put all aspects of safety, planning, firearm/gear selection and site considerations together. The instruction contained in the segment will be the basis for putting everything into practice during the field simulation exercise.

Night-time Operations (30 minutes)
Segment will serve as an introduction to night-time collection of free ranging wildlife. Night operations are not inherently different from daytime operations, but do require some gear and some practices which differ from daytime work. This segment will cover those unique aspects, familiarity with specialized equipment, and provide a basis for the field simulation exercise.

Water based Operations (20 minutes)
Segment will address the unique nature of shooting over or on open water. In particular projectile trajectory for various firearms will be discussed, bullet skip, need for extended downrange clearance, and best firearm choices for wildlife collection on water.

PPE and Emergencies (30 minutes)
Segment will cover prevention and treatment of common injuries associated with field activities (burns, cuts, scrapes, sprains, etc). Also to be included, will be an emergency response template for medical emergencies, accidents, or the very rare event of a firearm related injury.

FIELD

3:30p.m. - Firearm Safety and Handling- Range
Practical hands-on session will include basic handling, carrying, loading and unloading, as well as a range shooting exercise.

5:00p.m. - Pre-scouting of Night Ops Shooting Sites
Session designed to instruct staff on individual site factors to assess as a prerequisite to a wildlife collection.

6:00p.m. - Dinner

7:30p.m. - Collection Simulations- Night Operations
Session is a live simulation of night wildlife collection based on classroom instruction, and pre-scouting and pre-planning efforts. Attendees will have an opportunity to use the specialized equipment to acquire and shoot a pre-set target in a realistic field setting.

DAY TWO

FIELD

8:30a.m. - Collection Simulations, continued- Day Operations
Session is a live simulation of daylight wildlife collection based on classroom and other portions of the training. Attendees will have hands-on opportunity to assess targets and shoot under realistic field conditions. 11:00a.m. - Elevated Shooting Platforms
Session will introduce attendees to various tree stands and other elevated shooting platforms with an emphasis on best safety practices (and PESH/OSHA requirements) for using these tools for wildlife collection purposes.

CLASSROOM

12:00p.m. - Wrap-up, evaluations, unanswered questions

1:00p.m. - Adjourn

Final Draft: May 13, 2

APPENDIX D

HEALTH AND SAFETY PROCEDURE
EXTREME TEMPERATURES

STANDARD OPERATING PROCEDURES IMPLEMENTATION FORM

DFWMR SOP # 20 (Last revised 3/29/04)

Health and Safety Policy or Program: **Extreme Temperature Conditions***

Underlying Regulation: **Department Policy OAD - 3, Workers Compensation**

Purpose of Policy or Program: **To insure the safety of all Division staff conducting field work in extreme heat and cold conditions**

Attach a list of Divisional employees who are affected by this policy or program. **All Division staff who conduct field work or are potentially exposed to extreme temperature conditions both hot and cold**

Identify who is responsible for implementing this policy or program. Indicate whether responsibilities are division wide or for a specific administrative unit.

Name	Responsibility	Unit
Arthur J. Newell	**Central Office**	**DFWMR**
Regional Managers	**All Regions**	**DFWMR**
Lab and Field Sta. Mgrs	**All Labs and Field Stations**	**DFWMR**
Fish Hatchery Managers	**All DEC Fish Hatcheries**	**Fisheries**
Game Farm Manager	**Reynolds Game Farm**	**Wildlife**

How does this Division comply with the training requirements of this policy or program ? (If applicable. Attach additional sheets as necessary) **Supervisors will insure that their staff read this SOP (SOP#20) and attachments, and other appropriate DFWMR SOP's included in the DFWMR SOP Manual and provide any additional level of instruction they deem necessary for handling adverse weather conditions. Attached to this SOP are a number of tip sheets, articles and website references for both Cold Weather and Hot Weather situations that all employees are encouraged to read. These attachments also describes common cold and heat related injuries, how to identify their symptoms and how to treat them in emergency situations.**

(See Attached)

Are there Medical Monitoring requirements under this standard ? ___ yes _**X**__no If yes, how does this division ensure compliance with these requirements ? (Attach additional sheets as necessary

Employees should inform their immediate supervisor of any medical condition or medications that will impact their ability to withstand working in extremes of heat and cold. Supervisors need to take these conditions into consideration when scheduling field work.

Are there Personal Protective Equipment requirements under this standard ? ____ yes **_X__** no
If yes, how is the proper selection, use and maintenance of PPE ensured. Attach separate sheets as necessary.

However there are personal protective equipment recommendations that employees need to consider when preparing for work in extreme weather conditions. These include selecting appropriate clothing to deal with the weather conditions. These recommendations are covered in the attached.

Specify other required implementation steps which may relate to this policy or program. Attach separate sheets as necessary.

Note: Prior to any field work conducted during extreme temperature or weather conditions, an emergency response plan (ERP) should be prepared which includes an evacuation plan for getting injured/sick staff immediate medical attention. All staff working on the field team should have a knowledge of the ERP and how to access help immediately.

Supervisors, crew leaders and individual employees need to consider the "heat index" and the "wind chill" when determining how (or whether) to complete scheduled field activities. Use the attached heat index table and wind chill chart to determine risks from temperature related conditions on the site.

Below are recommendations for working in hot conditions, include observing the "Heat Index Chart" (attached):

1) Exercise caution with scheduling work when "heat index temperatures" (apparent temperatures) exceeds 80 degrees (actual temperatures can range between 75 and 85 degrees depending on the humidity levels) with humidities exceeding 50%.

2) Exercise extreme caution when apparent temperatures exceed 90 degrees (actual temperatures can range between 80 and 95 depending on humidity levels) with humidities exceeding 30%.

3) <u>Minimize the length time of exposure to heat</u> when the apparent temperature exceeds 105 degrees (actual temperatures can range between 85 and 103 degrees) and humidities exceed 20 %.

4) <u>Avoid work outdoors</u> when apparent temperatures exceed 135 degrees (actual temperatures can range between 95 and 140 degrees).

<u>Below are recommendations for working in cold conditions, include observing the "Wind Chill Chart"(attached):</u>

1) Exercise <u>caution</u> anytime temperature (especially below 32 degrees) and wind combine to create conditions when employees could experience hyperthermia.

2) Exercise <u>extreme caution</u> when actual temperatures or wind chill temperatures are below -18 degrees, frostbite can occur on unprotected skin within 30 minutes.

3) <u>Minimize exposure</u> to actual temperature or wind chill temperatures below -30 degrees, frostbite can occur on unprotected skin within 10 minutes.

4) <u>Avoid work outdoors</u> when actual temperatures or wind chills are below -50 degrees, frostbite can occur on unprotected skin within 5 minutes.

**For the purposes of this SOP, "extreme temperature conditions" will be defined as that combination of weather and temperature conditions that could result in heat and cold related injuries such as frost bite, hypothermia, heat exhaustion and/or heat stroke under normal working conditions. This would include (but not limited to) temperature and humidity conditions that exceed an "apparent temperature" of 90 degrees (as defined in the Heat Index Table attached), wind chill factors below -18 degrees and/or a combination of air and water temperatures below 120 degrees (air temperature + water temperature = <120 degrees) when working in, on or near water.* Other combinations of weather, air and water temperature conditions could also present a significant risk of injury to DFWMR staff. Supervisors and DFWMR employees should recognize these conditions and take appropriate measures to prevent risk to themselves and their employees.

Attachments:

Appendix A: Hot Weather Working Condition Precautions, Heat Index Table

Appendix B: Cold Weather Working Condition Precautions, Wind Chill Chart

ATTACHMENT A

Hot Weather Working Condition Precautions

Heat Index Table

DFWMR Health and Safety SOP#20 Hot Weather Attachment (March 29, 2004)

Hot Weather Working Condtion Precautions:

WORKING IN HOT ENVIRONMENTS

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health
April 1986
Washington, DC 20402

DHHS (NIOSH) Publication No. 86-112
This publication is a revision of the 1980 pamphlet entitled "Hot Environments, " formerly DHHS(NIOSH) Publication No. 80—132.

INTRODUCTION

Being uncomfortable is not the major problem with working in high temperatures and humidities. Workers who are suddenly exposed to working in a hot environment face additional and generally avoidable hazards to their safety and health. The employer should provide detailed instructions on preventive measures and adequate protection necessary to prevent heat stress.

HOW THE BODY HANDLES HEAT

The human body, being warm blooded, maintains a fairly constant internal temperature, even though it is being exposed to varying environmental temperatures. To keep internal body temperatures within safe limits, the body must get rid of its excess heat, primarily through varying the rate and amount of blood circulation through the skin and the release of fluid onto the skin by the sweat glands. These automatic responses usually occur when the temperature of the blood exceeds 98.6oF and are kept in balance and controlled by the brain. In this process of lowering internal body temperature, the heart begins to pump more blood, blood vessels expand to accommodate the increased flow, and the microscopic blood vessels (capillaries) which thread through the upper layers of the skin begin to fill with blood. The blood circulates closer to the surface of the skin, and the excess heat is lost to the cooler environment.

If heat loss from increased blood circulation through the skin is not adequate, the brain continues to sense overheating and signals the sweat glands in the skin to shed large quantities of sweat onto the skin surface. Evaporation of sweat cools the skin, eliminating large quantities of heat from the body.

As environmental temperatures approach normal skin temperature, cooling of the body becomes more difficult. If air temperature is as warm as or warmer than the skin, blood brought to the body surface cannot lose its heat. Under these conditions, the heart continues to pump blood to the body surface, the sweat glands pour liquids containing electrolytes onto the surface of the skin and the evaporation of the sweat becomes the principal effective means of maintaining a constant body temperature. Sweating does not cool the body unless the moisture is removed from the skin by evaporation. Under conditions of high humidity, the evaporation of sweat from the skin is decreased and the body's efforts to maintain an acceptable body temperature may be significantly impaired. These conditions adversely affect an individual's ability to work in the hot environment. With so much blood going to the external surface of the body, relatively less goes to the active muscles, the brain, and other internal organs; strength declines; and fatigue occurs sooner than it would otherwise. Alertness and mental capacity also may be affected. Workers who must perform delicate or detailed work may find their accuracy suffering, and others may find their comprehension and retention of information lowered.

SAFETY PROBLEMS

Certain safety problems are common to hot environments. Heat tends to promote accidents due to the slipperiness of sweaty palms, dizziness, or the fogging of safety glasses. Wherever there exists molten metal hot surfaces, steam, etc., the possibility of burns from accidental contact also exists.

Aside from these obvious dangers, the frequency of accidents, in general appears to be higher in hot environments than in more moderate environmental conditions. One reason is that working in a hot environment lowers the mental alertness and physical performance of an individual. Increased body temperature and physical discomfort promote irritability, anger, and other emotional states which sometimes cause workers to overlook safety procedures or to divert attention from hazardous tasks.

HEALTH PROBLEMS

Excessive exposure to a hot work environment can bring about a variety of heat-induced disorders.

1) Heat Stroke

Heat stroke is the most serious of health problems associated with working in hot environments. It occurs when the body's temperature regulatory system fails and sweating becomes inadequate. The body's only effective means of removing excess heat is compromised with little warning to the victim that a crisis stage has been reached.

What are the warning signs of heat stroke

The victims of heat stroke are unable to notice the symptoms, and therefore, their survival depends on co-workers' ability to identify symptoms and to seek medical help.

While symptoms can vary from person to person, the warning signs of heat stroke can include complaints of sudden and severe fatigue, nausea, dizziness, lightheadedness, and profuse and prolonged sweating(sweating usually stops in severe cases). If a co-worker appears to be disorientated or confused (including euphoria), or has unaccountable irritability, malaise or flu-like symptoms, the worker should be moved to a cool location and seek medical advice.

A heat stroke victim's skin is hot, usually dry, red or spotted. Body temperature is usually 105oF or higher, and the victim is mentally confused, delirious, perhaps in convulsions, or unconscious. Unless the victim receives quick and appropriate treatment, death can occur.

Any person with signs or symptoms of heat stroke requires immediate hospitalization. However, first aid should be immediately administered. This includes removing the victim to a cool area, thoroughly soaking the clothing with water, and vigorously fanning the body to increase cooling. Further treatment at a medical facility should be directed to the continuation of the cooling process and the monitoring of complications which often accompany the heat stroke. Early recognition and treatment of heat stroke are the only means of preventing permanent brain damage or death.

What to Do

If you see any of these signs, you may be dealing with a life-threatening emergency. Have someone call for immediate medical assistance while you begin cooling the victim. Do the following:

* Remove the victim to a cooler area.
* Cool the victim rapidly using whatever methods you can. For example, immerse the victim in a tub of cool water **(Caution: This must only be done under constant supervision to prevent victim drowning)**; place the person in a cool shower; spray the victim with cool water from a garden hose; sponge the person with cool water; or if the humidity is low, wrap the victim in a cool, wet sheet and fan him or her vigorously. **(Do not use ice or ice cold water, only use cool water to cool the victim)**
* Monitor body temperature, and continue cooling efforts until the body temperature drops to 101-102°F.
* If emergency medical personnel are delayed, call the hospital emergency room for further instructions.
* Do not give the victim alcohol to drink.
* Get medical assistance as soon as possible.

Sometimes a victim's muscles will begin to twitch uncontrollably as a result of heat stroke. If this happens, keep the victim from injuring himself, but do not place any object in the mouth and do not give fluids. If there is vomiting, make sure the airway remains open by turning the victim on his or her side.

2) Heat Exhaustion

Heat exhaustion includes several clinical disorders having symptoms which may resemble the early symptoms of heat stroke. Heat exhaustion is caused by the loss of large amounts of fluid by

sweating, sometimes with excessive loss of salt. A worker suffering from heat exhaustion still sweats but experiences extreme weakness or fatigue, giddiness, nausea, or headache. In more serious cases, the victim may vomit or lose consciousness. The skin is clammy and moist, the complexion is pale or flushed, and the body temperature is normal or only slightly elevated.

In most cases, treatment involves having the victim rest in a cool place and drink plenty of liquids. Victims with mild cases of heat exhaustion usually recover spontaneously with this treatment. Those with severe cases may require extended care for several days. There are no known permanent effects.
CAUTION
Persons with heart problems or those on a low sodium diet who work in hot environments should consult a physician about what to do under these conditions.

What to Do

Cooling measures that may be effective include the following:

* Cool, nonalcoholic beverages, as directed by your physician
* Rest
* Cool shower, bath, or sponge bath
* An air-conditioned environment
* Lightweight clothing

3) Heat Cramps

Heat cramps are painful spasms of the muscles that occur among those who sweat profusely in heat, drink large quantities of water, but do not adequately replace the body's salt loss. The drinking of large quantities of water tends to dilute the body's fluids, while the body continues to lose salt. Shortly thereafter, the low salt level in the muscles causes painful cramps. The affected muscles may be part of the arms, legs, or abdomen, but tired muscles (those used in performing the work) are usually the ones most susceptible to cramps. Cramps may occur during or after work hours and may be relived by taking salted liquids by mouth.
CAUTION
Persons with heart problems or those on a low low sodium diet who work in hot environments should consult a physician about what to do under these conditions.

What to Do

If medical attention is not necessary, take these steps:

* Stop all activity, and sit quietly in a cool place.
* Drink clear juice, a sports beverage or large glass of water with just enough salt added to provide a “salt taste.” Do not give large quantities of salt directly to the victim.
* Do not return to strenuous activity for a few hours after the cramps subside, because further exertion may lead to heat exhaustion or heat stroke.
* Seek medical attention for heat cramps if they do not subside in 1 hour.

4) Fainting

A worker who is not accustomed to hot environments and who stands erect and immobile in the heat may faint. With enlarged blood vessels in the skin and in the lower part of the body due to the body's attempts to control internal temperature, blood may pool there rather than return to the heart to be pumped to the brain.

What to Do

Have patient lay down, elevate feet and they should soon recover. By moving around, and thereby preventing blood from pooling, the patient can prevent further fainting.

5) Heat Rash

Heat rash, also known as prickly heat, is likely to occur in hot, humid environments where sweat is not easily removed from the surface of the skin by evaporation and the skin remains wet most of the time. The sweat ducts become plugged, and a skin rash soon appears. When the rash is extensive or when it is complicated by infection, prickly heat can be very uncomfortable and may reduce a worker's performance. The worker can prevent this condition by resting in a cool place part of each day and by regularly bathing and drying the skin.

What to Do

The best treatment for heat rash is to provide a cooler, less humid environment. Keep the affected area dry. Dusting powder may be used to increase comfort, but avoid using ointments or creams -- they keep the skin warm and moist and may make the condition worse.

Treating heat rash is simple and usually does not require medical assistance. Other heat-related problems can be much more severe.

6) Transient Heat Fatigue

Transient heat fatigue refers to the temporary state of discomfort and mental or psychologic strain arising from prolonged heat exposure. Workers unaccustomed to the heat are particularly susceptible and can suffer, to varying degrees, a decline in task performance, coordination, alertness, and vigilance. The severity of transient heat fatigue will be lessened by a period of gradual adjustment to the hot environment (heat acclimatization).

What to Do

Have workers take frequent rest breaks, provide ample fluids, dress in loose fitting, light colored clothing, minimize exertion during hottest portion of the day, allow body to become acclimated to the heat.

7) Sunburn

Sunburn should be avoided because it damages the skin. Although the discomfort is usually minor and healing often occurs in about a week, a more severe sunburn may require medical attention.

Recognizing Sunburn

Symptoms of sunburn are well known: skin becomes red, painful, and abnormally warm after sun exposure.

What to Do

Consult a doctor if the sunburn affects an infant younger than 1 year of age or if these symptoms are present:

* Fever
* Fluid-filled blisters
* Severe pain

Also, remember these tips when treating sunburn:

* Avoid repeated sun exposure.
* Apply cold compresses or immerse the sunburned area in cool water.
* Apply moisturizing lotion to affected areas. Do not use salve, butter, or ointment.
* Do not break blisters.

PREPARING FOR THE HEAT

One of the best ways to reduce heat stress on workers is to minimize exposure and duration to heat in the workplace. However, when working in the field this may be difficult, in these conditions judgement on the part of the supervisor and the individual is critical in helping to prevent heat related illnesses. Following the recommendations below will help employees avoid conditions that lead to heat stress and/or will allow the recognition of heat stress problems and take action to resolve them.

Humans are, to a large extent, capable of adjusting to the heat. This adjustment to heat, under normal circumstances, usually takes about 5 to 7 days, during which time the body will undergo a series of changes that will make continued exposure to heat more endurable.

On the first day of work in a hot environment, the body temperature, pulse rate, and general discomfort will be higher. With each succeeding daily exposure, all of these responses will gradually decrease, while the sweat rate will increase. When the body becomes acclimated to the heat, the worker will find it possible to perform work with less strain and distress.

Gradual exposure to heat gives the body time to become accustomed to higher environmental temperatures. Heat disorders in general are more likely to occur among workers who have not been given time to adjust to working in the heat or among workers who have been away from hot environments and who have gotten accustomed to lower temperatures. Hot weather conditions of the summer are likely to affect the worker who is not acclimatized to heat. Likewise, workers who return to work after a leisurely vacation or extended illness may be affected by the heat in

the work environment. Whenever such circumstances occur, the worker should be gradually reacclimatized to the hot environment.

LESSENING STRESSFUL CONDITIONS

Many industries have attempted to reduce the hazards of heat stress by introducing engineering controls, training workers in the recognition and prevention of heat stress, and implementing work-rest cycles. Heat stress depends, in part, on the amount of heat the worker's body produces while a job is being performed. The amount of heat produced during hard, steady work is much higher than that produced during intermittent or light work. Therefore, one way of reducing the potential for heat stress is to make the job easier or lessen its duration by providing adequate rest time. Mechanization of work procedures can often make it possible to isolate workers from the heat sources (perhaps in an air-conditioned booth) and increase overall productivity by decreasing the time needed for rest. Another approach to reducing the level of heat stress is the use of engineering controls which include ventilation and heat shielding.

Number and Duration of Exposures

Rather than be exposed to heat for extended periods of time during the course of a job, workers should, wherever possible, be permitted to distribute the workload evenly over the day and incorporate work-rest cycles. Work-rest cycles give the body an opportunity to get rid of excess heat, slow down the production of internal body heat, and provide greater blood flow to the skin.

Workers employed outdoors are especially subject to weather changes. A hot spell or a rise in humidity can create overly stressful conditions. The following practices can help to reduce heat stress:

* Postponement of nonessential tasks,
* Permit only those workers acclimatized to heat to perform the more strenuous tasks, or
* Provide additional workers to perform the tasks keeping in mind that all workers should have the physical capacity to perform the task and that they should be accustomed to the heat.

Thermal Conditions in the Workplace

A variety of engineering controls can be introduced to minimize exposure to heat. For instance, improving the insulation on a furnace wall can reduce its surface temperature and the temperature of the area around it. In a laundry room, exhaust hoods installed over those sources releasing moisture will lower the humidity in the work area. In general the simplest and least expensive methods of reducing heat and humidity can be accomplished by:

* Opening windows in hot work areas,
* Using fans, or
* Using other methods of creating airflow such as exhaust ventilation or air blowers.

Rest Areas

Providing cool rest areas in hot work environments considerably reduces the stress of working in those environments. There is no conclusive information available on the ideal temperature for a rest area. However, a rest area with a temperature near 76/F appears to be adequate and may

even feel chilly to a hot, sweating worker, until acclimated to the cooler environment. The rest area should be as close to the workplace as possible. Individual work periods should not be lengthened in favor of prolonged rest periods. Shorter but frequent work-rest cycles are the greatest benefit to the worker.

Drinking Water

In the course of a day's work in the heat, a worker may produce as much as 2 to 3 gallons of sweat. Because so many heat disorders involve excessive dehydration of the body, it is essential that water intake during the workday be about equal to the amount of sweat produced. Most workers exposed to hot conditions drink less fluids than needed because of an insufficient thirst drive. A worker, therefore, should not depend on thirst to signal when and how much to drink. Instead, the worker should drink 5 to 7 ounces of fluids every 15 to 20 minutes to replenish the necessary fluids in the body. There is no optimum temperature of drinking water, but most people tend not to drink warm or very cold fluids as readily as they will cool ones. Whatever the temperature of the water, it must be palatable and readily available to the worker. Individual drinking cups should be provided--never use a common drinking cup.

Heat acclimatized workers lose much less salt in their sweat than do workers who are not adjusted to the heat. The average American diet contains sufficient salt for acclimatized workers even when sweat production is high. If, for some reason, salt replacement is required, the best way to compensate for the loss is to add a little extra salt to the food. Salt tablets should not be used.
CAUTION
Persons with heart problems or those on a low sodium diet who work in hot environments should consult a physician about what to do under these conditions.

Protective Clothing
Clothing inhibits the transfer of heat between the body and the surrounding environment. Therefore, in hot jobs where the air temperature is lower than skin temperature, wearing clothing reduces the body's ability to lose heat into the air.

When air temperature is higher than skin temperature, clothing helps to prevent the transfer of heat from the air to the body. However, this advantage may be nullified if the clothes interfere with the evaporation of sweat.

In dry climates, adequate evaporation of sweat is seldom a problem. In a dry work environment with very high air temperatures, protective clothing could be an advantage to the worker. The proper type of clothing depends on the specific circumstance. Certain work in hot environments may require insulated gloves, insulated suits, reflective clothing, or infrared reflecting face shields. For extremely hot conditions, thermally conditioned clothing is available. One such garment carries a self-contained air conditioner in a backpack, while another is connected a compressed air source which feeds cool air into the jacket or coveralls through a vortex tube. Another type of garment is a plastic jacket which has pockets that can be filled with dry ice or containers of ice.

AWARENESS IS IMPORTANT

The key to preventing excessive heat stress is educating the employer and worker on the hazards of working in heat and the benefits of implementing proper controls and work practices. The employer should establish a program designed to acclimatize workers who must be exposed to hot environments and provide necessary work-rest cycles and water to minimize heat stress.

SPECIAL CONSIDERATIONS DURING PROLONGED HEAT SPELLS

During unusually hot weather conditions lasting longer than 2 days, the number of heat illnesses usually increases. This is due to several factors, such as progressive body fluid deficit, loss of appetite (and possible salt deficit), buildup of heat in living and work areas, and breakdown of air-conditioning equipment. Therefore, it is advisable to make a special effort to adhere rigorously to the above preventive measures during these extended hot spells and to avoid any unnecessary or unusual stressful activity. Sufficient sleep and good nutrition are important for maintaining a high level of heat tolerance. Workers who may be at a greater risk of heat illnesses are the obese, the chronically ill, and older individuals.

When feasible, the most stressful tasks should be performed during the cooler parts of the day (early morning or at night). Double shifts and overtime should be avoided whenever possible. Rest periods should be extended to alleviate the increase in the body heat load.

The consumption of alcoholic beverages during prolonged periods of heat can cause additional dehydration. Persons taking certain medications (e.g., medications for blood pressure control, diuretics, or water pills) should consult their physicians in order to determine if any side effects could occur during excessive heat exposure. Daily fluid intake must be sufficient to prevent significant weight loss during the workday and over the workweek.

SOURCES OF ADDITIONAL INFORMATION

1. American Conference of Governmental Industrial Hygienists [1991]. TLVs. threshold limit values and biological exposure indices for 1985-86, Cincinnati OH: ACGIH pp. 91-98.
2. NIOSH [1986]. Criteria for a recommended standard . . occupational exposure to hot environments - revised criteria. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS(NIOSH) Publication No. 86-113.
3. NIOSH [1976]. Standards for occupational exposures to hot environments--proceedings of symposium. Cincinnati, OH: U.S. Department of Health, Education and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, HEW(NIOSH) Publication No. 76-100.
4. Westinghouse Electric Corporation [1986]. Heat stress management program for nuclear power plants. University Park, PA: Pennsylvania State University, GPU Nuclear Corporation.

NIOSH DIRECTORY

General Inquiries 1-800-35-NIOSH (1-800-356-4674)
Publications Office FAX (513) 533-8573

Extreme Heat
Tips on Preventing and Managing Heat

The best defense is prevention. Here are some prevention tips:

* Drink more fluids (nonalcoholic), regardless of your activity level. Don't wait until you're thirsty to drink. Warning: If your doctor generally limits the amount of fluid you drink or has you on water pills, ask him how much you should drink while the weather is hot.

* Don't drink liquids that contain caffeine, alcohol, or large amounts of sugar–these actually cause you to lose more body fluid. Also, avoid very cold drinks, because they can cause stomach cramps.

* Stay indoors and, if at all possible, stay in an air-conditioned place. If your home does not have air conditioning, go to the shopping mall or public library–even a few hours spent in air conditioning can help your body stay cooler when you go back into the heat. Call your local health department to see if there are any heat-relief shelters in your area.

* Electric fans may provide comfort, but when the temperature is in the high 90s, fans will not prevent heat-related illness. Taking a cool shower or bath, or moving to an air-conditioned place is a much better way to cool off.

* Wear lightweight, light-colored, loose-fitting clothing.

* NEVER leave anyone in a closed, parked vehicle.

* Although any one at any time can suffer from heat-related illness, some people are at greater risk than others. Check regularly on:
    - o Infants and young children
    - o People aged 65 or older
    - o People who have a mental illness
    - o Those who are physically ill, especially with heart disease or high blood pressure

* Visit adults at risk at least twice a day and closely watch them for signs of heat exhaustion or heat stroke. Infants and young children, of course, need much more frequent watching.

If you must be out in the heat:

* Limit your outdoor activity to morning and evening hours.

* Cut down on exercise. If you must exercise, drink two to four glasses of cool, nonalcoholic fluids each hour. A sports beverage can replace the salt and minerals you lose in sweat. Warning: If you are on a low-salt diet, talk with your doctor before drinking a sports beverage. Remember the warning in the first "tip" (above), too.

* Try to rest often in shady areas.

* Protect yourself from the sun by wearing a wide-brimmed hat (also keeps you cooler) and sunglasses and by putting on sunscreen of SPF 15 or higher (the most effective products say “broad spectrum” or “UVA/UVB protection” on their labels).

Heat Index Table

Apparent temperature heat stress index

Category	Apparent temperature	Dangers
Caution	80-90°F	Exercise more fatiguing than usual
Extreme caution	90-105°F	Heat stroke, heat cramps, exhaustion possible
Danger	105-130°F	Heat stroke and exhaustion likely
Extreme danger	Greater than 130°F	Heat stroke imminent

The Heat Index

The heat index combines the effects of heat and humidity. When heat and humidity combine to reduce the amount of evaporation of sweat from the body, outdoor exercise becomes dangerous even for those in good shape. Key rules for coping with heat are to drink plenty of water to avoid dehydration and to slow down and cool off when feeling fatigued, a headache, a high pulse rate or shallow breathing. Overheating can cause serious, even life-threatening conditions such as heat stroke. The apparent temperature, which combines the temperature and relative humidity, is a guide to the danger.

APPENDIX B

Cold Weather Working Condition Precautions

Wind Chill Chart

Brrrrrr! Cold Weather Tips from OSHA

It''s that time of year again——winter——when many people across the United States experience bitter temperatures and increased dangers.

Working in cold environments can be dangerous with more than 700 people a year dying of cold-related deaths in the United States. To help protect workers in these cold times, OSHA reminds employers and workers to take simple precautions.

Prolonged exposure to freezing or cold temperatures can result in health problems such as trench foot, frostbite and hypothermia. When the body is unable to warm itself, serious cold-related illnesses and injuries may occur, and permanent tissue damage and death may result. Employers and workers need to take precautions and learn how to prevent and treat cold-related disorders.

OSHA''s Cold Stress Card provides recommendations that can prevent many illnesses and injuries. Available in English and Spanish, this laminated card is free to employers to distribute to workers.

Here are some reminders from OSHA about staying safe in cold weather:

How to Protect Workers:

•Recognize the environment and workplace conditions that lead to potential cold-induced illnesses and injuries.

•Learn the signs and symptoms of cold-induced illnesses/injuries and what to do to help workers.

•Train workers about cold-induced illnesses and injuries.

•Encourage workers to wear proper clothing for cold, wet and windy conditions. Layer clothing to adjust to changing environment temperatures. Wear a hat and gloves, in addition to underwear that will keep water away from the skin.

•Be sure that workers take frequent short breaks in warm, dry shelters to allow the body to warm up.

•Try to schedule work for the warmest part of the day.

•Avoid exhaustion or fatigue because energy is needed to keep muscles warm.

•Use the buddy system——work in pairs so that one worker can recognize danger signs.

•Drink warm, sweet beverages (sugar water and sports-type drinks) and avoid drinks with caffeine or alcohol.

•Eat warm, high-calorie foods such as hot pasta dishes.

•Remember: Workers face increased risks when they take certain medications, are in poor physical condition or suffer from illnesses such as diabetes, hypertension or cardiovascular disease.

For free copies of OSHA''s Cold Stress Card in English or Spanish, visit www.osha.gov, click on Newsroom, then Publications.

How we lose heat

1. Radiation - loss of heat to the environment due to the temperature gradient (this occurs only as long as the ambient temperature is below 98.6). Factors important in radiant heat loss are the surface area and the temperature gradient.
2. Conduction - through direct contact between objects, molecular transference of heat energy
   * Water conducts heat away from the body 25 times faster than air because it has a greater density (therefore a greater heat capacity). Stay dry = stay alive!
   * Steel conducts heat away faster than water

Example: Generally conductive heat loss accounts for only about 2% of overall loss. However, with wet clothes the loss is increased 5x.

3. Convection - is a process of conduction where one of the objects is in motion. Molecules against the surface are heated, move away, and are replaced by new molecules which are also heated. The rate of convective heat loss depends on the density of the moving substance (water convection occurs more quickly than air convection) and the velocity of the moving substance.
   * Wind Chill - is an example of the effects of air convection, the wind chill table gives a reading of the amount of heat lost to the environment relative to a still air temperature.
4. Evaporation - heat loss from converting water from a liquid to a gas
   * Perspiration - evaporation of water to remove excess heat
     o Sweating - body response to remove excess heat
     o Insensible Perspiration - body sweats to maintain humidity level of 70% next to skin - particularly in a cold, dry environment you can lose a great deal of moisture this way
     o Respiration - air is heated as it enters the lungs and is exhaled with an extremely high moisture content
     o It is important to recognize the strong connection between fluid levels, fluid loss, and heat loss. As body moisture is lost through the various evaporative processes the overall circulating volume is reduced which can lead to dehydration. This decrease in fluid level makes the body more susceptible to hypothermia and other cold injuries.

Dressing for the Cold

You must not only have enough clothing to protect you from the cold, you must also know how to maximize the warmth you get from it. For example, always keep your head covered. You can lose 40 to 45 percent of body heat from an unprotected head and even more from the unprotected neck, wrist, and ankles. These areas of the body are good radiators of heat and have very little insulating fat. The brain is very susceptible to cold and can stand the least amount of cooling. Because there is much blood circulation in the head, most of which is on the surface, you can lose heat quickly if you do not cover your head.

There are four basic principles to follow to keep warm. An easy way to remember these basic principles is to use the word COLD--

C - Keep clothing clean.

O - Avoid overheating.

L - Wear clothes loose and in layers.

D - Keep clothing dry.

THE ART OF LAYERING Clothing

Air trapped between layers of clothes insulates better than a single heavy garment. Here are the basics.

Layer 1.

Start with an undershirt or long johns in fabrics which trap body heat and wick moisture away from skin. Socks should be made of wool or wick-dry synthetics like Coolmax, wear sock liners made of polypro. Avoid wearing cotton next to the skin as it will not wick moisture away from the body and will not dry quickly. A cotton-poly blend is better and will dry quicker than 100% cotton material.

Layer 2.

Wear long-sleeved fleece or synthetic materials for best moisture wick properties, cotton flannel shirts will allow moisture to evaporate, but tend to dry slowly if wet.

Layer 3.

Pants and vests made of wool or fleece keep body core warm without bulk, avoid blue jeans. Waterproof boots with felt liners or other insulation keep feet dry and warm, make sure you have plenty of room for toe movement.

Layer 4

Choose coats and jackets with fleece linings and outer shells made of wind and water-resistant nylon (Gore Tex or other waterproof, breathable material). Fleece is the fabric favored by professional skiers and mountain climbers because it retains natural body warmth even when wet and has a very high "warmth to weight" ratio making it effective without being bulky. Down is good so long as it stays dry, once wet down is next to worthless. Special Note: If working on or near the water during cold weather, wear a PFD (personal flotation device as it will not only keep you afloat but also help keep you warm.

Layer 5.

Hats and neck warmers go a long way in keeping the entire body warm, since we lose more than half our body heat from our heads. Wear mittens when temperatures are extreme so that fingers can communicate with each other.

FROSTNIP

* Freezing of top layers of skin tissue

* It is generally reversible

* White, waxy skin, top layer feels hard, rubbery but deeper tissue is still soft

* Numbness

* Most typically seen on cheeks, earlobes, fingers, and toes

Treatment

* Rewarm the area gently, generally by blowing warm air on it or placing the area against a warm body part (partner's stomach or armpit)

* Do not rub the area - this can damage the effected tissue by having ice crystals tear the cell

* IF CONDITIONS DO NOT IMPROVE WITH REWARMING, SEEK MEDICAL ATTENTION.

FROSTBITE

Cause: Freezing of skin or tissues due to exposure to temperatures at or below freezing.

Commonly by exposure to liquids that freeze at low temperatures such as gasoline, cleaning solvents, and salt water, or high velocity wind flow or metal surfaces.

EXPOSURE CAN OCCUR IN MINUTES! (SEE ATTACHED WIND CHILL CHART)

Wind or contact with wet clothing may produce an effective temp in freezing range when air temperature is above freezing.

SYMPTOMS: First degree: Aching, tingling sensation with cold and numbness. Skin usually turns red.

Second degree: Pale grey and waxy white.

Third degree: Black--no feeling no blood flow

TREATMENT: Handle gently--same as trench foot. DO NOT use water to warm affected areas.

CHEEKS: Cover with warm hands until pain returns

FINGERS: Place uncovered under arm pits or belly next to skin.

FEET: Bare feet against belly of companion, under clothing avoid rubbing or massaging. Don't pop blisters!

CLOTHING: DRY, and proper for weather.

EXERCISE: Routine exercise of face, fingers, and toes.

SEEK MEDICAL ATTENTION AS SOON AS POSSIBLE.

COLD CAUSED EYE INJURIES

a. Freezing of Cornea

* Caused by forcing the eyes open during strong winds without goggles

* Treatment is very controlled, rapid rewarming e.g. placing a warm hand or compress over the closed eye. After rewarming the eyes must be completely covered with patches for 24 - 48 hours.

* SEEK MEDICAL ATTENTION AS SOON AS POSSIBLE.

b. Eyelashes freezing together

* Put hand over eye until ice melts, then can open the eye

c. Snowblindness

* Sunburn of the eyes

* Prevention by wearing good sunglasses with side shields or goggles. Eye protection from sun is just as necessary on cloudy or overcast days as it is in full sunlight when you are on snow. Snow

blindness can even occur during a snow storm if the cloud cover is thin.

Symptoms

* Occur 8-12 hours after exposure

* Eyes feel dry and irritated, then feel as if they are full of sand, moving or blinking becomes extremely painful, exposure to light hurts the eyes, eyelids may swell, eye redness, and

excessive tearing

* IF SYMPTOMS PERSIST SEEK MEDICAL ATTENTION.

HYPOTHERMIA: SIGNS AND TREATMENT

Hypothermia - "a decrease in the core body temperature to a level at which normal muscular and cerebral functions are impaired." - Medicine for Mountaineering

Conditions Leading to Hypothermia

* Cold temperatures
* Improper clothing and equipment
* Wetness
* Fatigue, exhaustion
* Dehydration
* Poor food intake
* No knowledge of hypothermia
* Alcohol intake - causes vasodilation leading to increased heat loss

What are "hypothermia" temperatures

* Below freezing
* 40 degrees - Ex. Shenandoahs, wind and rain
* 60 degrees - Ex. Rayanna and hurricane
* Any temperature less than 98.6 degrees can be linked to hypothermia (ex. hypothermia in the elderly in cold houses) or peripheral circulation problems such as trench foot and frostbite.

Signs and Symptoms of Hypothermia

a. Watch for the "-Umbles" - stumbles, mumbles, fumbles, and grumbles which show changes in motor coordination and levels of consciousness

b. Mild Hypothermia - core temperature 98.6 - 96 degrees F

* Shivering - not under voluntary control
* Can't do complex motor functions (ice climbing or skiing) can still walk & talk
* Vasoconstriction to periphery

c. Moderate Hypothermia - core temperature 95 - 93 degrees F

* Dazed consciousness

* Loss of fine motor coordination - particularly in hands - can't zip up parka, due to restricted peripheral blood flow

* Slurred speech

* Violent shivering

* Irrational behavior - Paradoxical Undressing - person starts to take off clothing, unaware s/he is cold

* "I don't care attitude" - flattened affect

* IF SYMPTOMS DON'T ABATE UPON REWARMING, SEEK MEDICAL ATTENTION IMMEDIATELY.

d. Severe Hypothermia - core temperature 92 - 86 degrees and below (immediately life threatening)

* Shivering occurs in waves, violent then pause, pauses get longer until shivering finally ceases - because the heat output from burning glycogen in the muscles is not sufficient

to counteract the continually dropping core temperature, the body shuts down on shivering to conserve glucose

* Person falls to the ground, can't walk, curls up into a fetal position to conserve heat

* Muscle rigidity develops - because peripheral blood flow is reduced and due to lactic acid and CO2 buildup in the muscles

* Skin is pale

* Pupils dilate

* Pulse rate decreases

* at 90 degrees the body tries to move into hibernation, shutting down all peripheral blood flow and reducing breathing rate and heart rate.

* at 86 degrees the body is in a state of "metabolic icebox." The person looks dead but is still alive.

*SEEK MEDICAL ATTENTION IMMEDIATELY OR TRANSPORT TO THE NEAREST MEDICAL FACILITY.

e. Death from Hypothermia

* Breathing becomes erratic and very shallow

* Semi-conscious

* Cardiac arrythmias develop, any sudden shock may set off Ventricular Fibrillation

* Heart stops, death

How to Assess if someone is Hypothermic

* If shivering can be stopped voluntarily = mild hypothermia

* Ask the person a question that requires higher reasoning in the brain (count backwards from 100 by 9's). If the person is hypothermic, they won't be able to do it. [Note: there are also other conditions such as altitude sickness that can also cause the same condition.]

* If shivering cannot be stopped voluntarily = moderate - severe hypothermia

* If you can't get a radial pulse at the wrist it indicates a core temp below 90 - 86 degrees

* The person may be curled up in a fetal position. Try to open their arm up from the fetal position, if it curls back up, the person is alive. Dead muscles won't contract only live muscles.

Treating Hypothermia

The basic principles of rewarming a hypothermic victim are to conserve the heat they have and replace the body fuel they are burning up to generate that heat. If a person is shivering, they have the ability to rewarm themselves at a rate of 2 degrees C per hour.

Mild - Moderate Hypothermia

1. Reduce Heat Loss

* Additional layers of clothing

* Dry clothing

* Increased physical activity

* Shelter

2. Add Fuel & Fluids

It is essential to keep a hypothermic person adequately hydrated and fueled.

a. Food types

* Carbohydrates - 5 calories/gram - quickly released into blood stream for sudden brief heat surge - these are the best to use for quick energy intake especially for mild cases of hypothermia

* Proteins - 5 calories/gram - slowly released - heat given off over a longer period

* Fats - 9 calories/gram - slowly released but are good because they release heat over a long period, however, it takes more energy to break fats down into glucose - also takes more water to break down fats leading to increased fluid loss

b. Food intake

* Hot liquids - calories plus heat source

* Sugars (kindling)

* GORP - has both carbohydrates (sticks) and proteins/fats (logs)

c. Things to avoid

* Alcohol - a vasodilator - increases peripheral heat loss

* Caffeine - a diuretic - causes water loss increasing dehydration

* Tobacco/nicotine - a vasoconstrictor, increases risk of frostbite

3. Add Heat

Caution: any external heat source applied to the bare skin must be wrapped in cloth to prevent burning of the skin! Extreme care needs to be taken when using an open flame to rewarm a hyprothermic victim to avoid burning.

* Fire or other external heat source

* Body to body contact. Get into a sleeping back, in dry clothing with a normothermic person in lightweight dry clothing

<u>Severe Hypothermia</u>

1. Reduce Heat Loss

* Hypothermia Wrap: The idea is to provide a shell of total insulation for the patient. No matter how cold, patients can still internally rewarm themselves much more efficiently than any external rewarming. Make sure the patient is dry, and has a polypropylene layer to minimize sweating on the skin. The person must be protected from any moisture in the environment. Use multiple sleeping bags, wool blankets, wool clothing, Ensolite pads to create a minimum of 4" of insulation all the way around the patient, especially between the patient and the ground. Include an aluminum "space" blanket to help prevent radiant heat loss, and wrap the entire ensemble in plastic to protect from wind and water. If someone is truly hypothermic, don't put him/her naked in a sleeping bag with another person.

See Special Note Below.

2. Add Fuel & Fluids

Caution: Food should not be given to severely hypothermic victim unless they have control over their swallowing reflex, otherwise choking can occur.

* Warm Sugar Water - for people in severe hypothermia, the stomach has shut down and will not digest solid food but can absorb water and sugars. Give a dilute mixture of warm water with sugar every 15 minutes. Dilute Jell-O™ works best since it is part sugar and part protein. This will be absorbed directly into the blood stream providing the necessary calories to allow the person to rewarm themselves. One box of Jello = 500 Kilocalories of heat energy. Do not give full strength Jello even in liquid form, it is too concentrated and will not be absorbed.

* Urination - people will have to urinate from cold diuresis. Vasoconstriction creates greater volume pressure in the blood stream. The kidneys pull off excess fluid to reduce the pressure. A full bladder results in body heat being used to keep urine warm rather than vital organs. Once the person has urinated, it precious body heat will be used to maintain the temperature of vital organs. So in the end urinating will help conserve heat. You will need to help the person urinate. Open up the Hypothermia Wrap enough to do this and then cover them back up. You will need to keep them hydrated with the dilute Jello solution described above.

3. Add Heat

Heat can be applied to transfer heat to major arteries - at the neck for the carotid, at the armpits for the brachial, at the groin for the femoral, at the palms of the hands for the arterial arch.

Caution: any external heat source applied to the bare skin must be wrapped in cloth to prevent burning of the skin!

* Chemical heat packs such as the Heat Wave™ provides 110 degrees F for 6-10 hours.

* Hot water bottles, warm rocks, towels, compresses

* For a severely hypothermic person, rescue breathing can increase oxygen and provide internal heat.

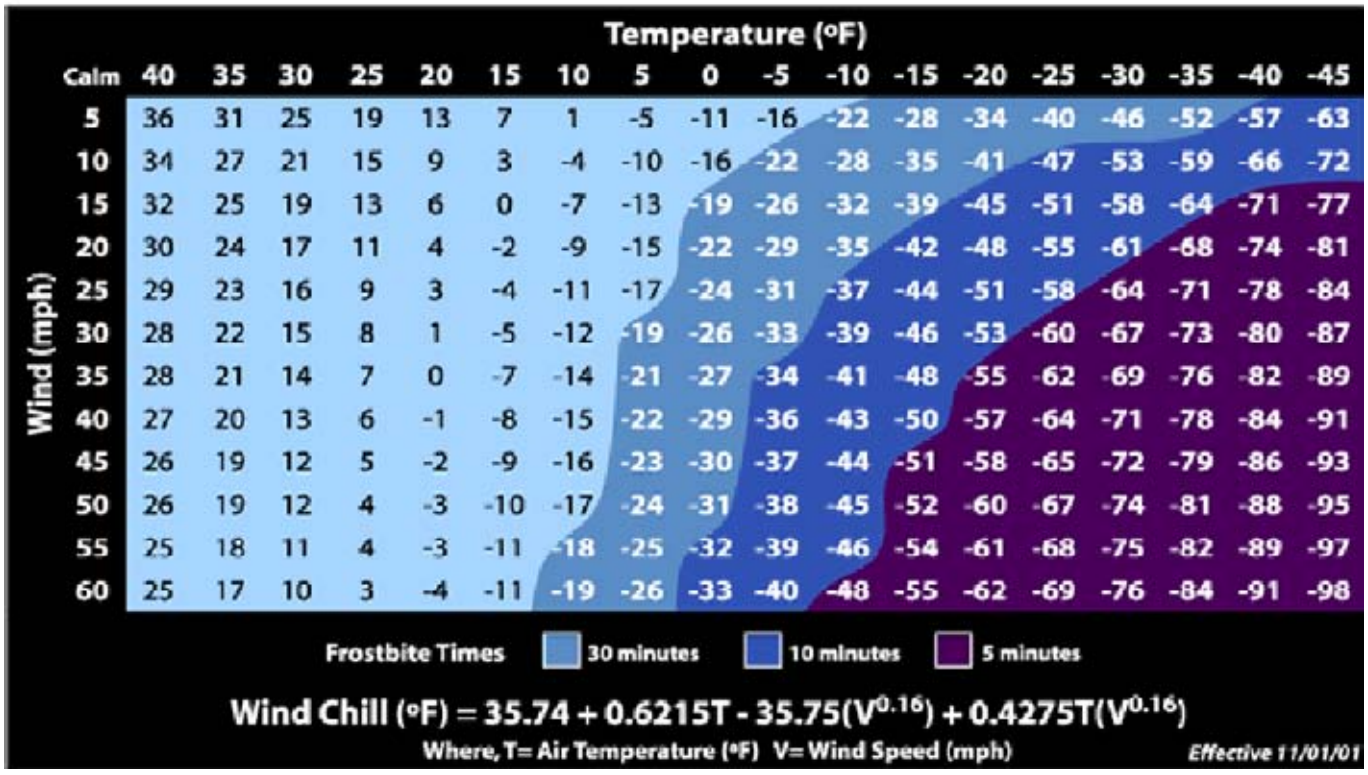
See Special Note Below.

AFTERDROP

Is a situation in which the core temperature actually decreases during rewarming. This is caused by peripheral vessels in the arms and legs dilating if they are rewarmed. This dilation sends this very cold, stagnate blood from the periphery to the core further decreasing core temperature which can lead to death. In addition, this blood also is very acidic which may lead to cardiac arrythmias and death. Afterdrop can best be avoided by not rewarming the periphery. Rewarm the core only! Do not expose a severely hypothermic victim to extremes of heat.

Special Note: The best you can do for severe hypothermia in the field without advanced medical help is place the victim in a warm area(not above 90 degrees) apply heat pacs to

the head and neck, wrap the head, neck, and torso to prevent any further heat loss, and most importantly, leave the arms and legs exposed without applying any external heat source except room air temperature. Bottom line is you want to stop the victim from getting any colder without rewarming them to quickly. The victim needs to be rewarmed in a hospital setting(preferably at a trauma center) for the best chance of survival.




U.S. DEPARTMENT OF THE INTERIOR
MARCH 3, 1849


NOAA


NEW YORK STATE