

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD

_____)	
In the Matter of)	
)	
Entergy Nuclear Operations, Inc.)	Docket Nos.
(Indian Point Nuclear Generating)	50-247-LR
Units 2 and 3))	and 50-286-LR
_____)	

**PREFILED WRITTEN TESTIMONY OF GILLIAN STEWART
REGARDING CONTENTION RK-EC-3/CW-EC-1 (SPENT FUEL POOL LEAKS)**

On behalf of Riverkeeper, Inc. (“Riverkeeper”), Gillian Stewart submits the following testimony regarding Consolidated Contention RK-EC-3/CW-EC-1:

1 **Q. Please state your name and address.**

2 A. My name is Gillian Stewart and my business address is School of Earth and
3 Environmental Sciences, Queens College, CUNY, 65-30 Kissena Blvd., Flushing, NY 11367
4

5 **Q. What is your educational and professional background?**

6 A. My undergraduate degree is in Biology Magna Cum Laude from Harvard University in
7 1997. My doctoral degree is from the School of Marine and Atmospheric Sciences (formerly
8 Marine Sciences Research Center) at Stony Brook University in Coastal Oceanography (2005).
9 The title of my thesis was “The Accumulation and Trophic Transfer of Polonium-210:
10 Biogeochemical Implications.” My thesis advisors were Dr. Nicholas Fisher, a marine radio-
11 ecologist, and Dr. Kirk Cochran, a marine radio-geochemist. I performed much of my doctoral
12 research at the IAEA Marine Laboratory in Monaco under the supervision of Dr. Scott Fowler,
13 an aquatic radio-chemist and radio-ecologist.

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15
16

1 **Q. Can you please discuss your experience as it relates to fate, transport, and**
2 **accumulation of radionuclides in aquatic systems.**

3 A. Although my thesis work and subsequent research has primarily focused on natural
4 (primordial, U-series) radionuclides, I have taken numerous courses in radiochemistry, radio-
5 ecology, and marine pollution. I specifically study the grandmother/grand-daughter isotope pair
6 of lead-210 and polonium-210. These isotopes each exhibit unique behavior in aquatic systems
7 and act as model particle-reactive radiogenic isotopes. I have written over 18 papers on radio-
8 isotope fractionation between the dissolved and particulate pool in aquatic systems, and have
9 authored a book title called *Bioaccumulation of U/Th isotopes in marine organisms*. In addition
10 to my work on isotopes, I have studied trace metal accumulation in multiple freshwater,
11 estuarine, and marine systems including metal uptake by invertebrates of the Hudson River from
12 resuspended sediments after simulated dredging.

13

14 I am a tenured professor of Environmental Science at Queens College and have taught graduate
15 courses in Environmental Biogeochemistry, Marine Ecology, and Isotope Chemistry in Long
16 Island Sound, along with multiple undergraduate courses in Earth and Environmental Science,
17 Water Resources, and Oceanography.

18

19 **Q. What is the purpose of your testimony?**

20 A. The purpose of my testimony is to provide support for, and my views on, Riverkeeper
21 and Clearwater's Consolidated Contention RK-EC-3/CW-EC-1. This contention was admitted
22 by the Atomic Safety & Licensing Board ("ASLB") on July 31, 2008. Intervenors assert that
23 Entergy Nuclear Operations, Inc. ("Entergy") and the U.S. Nuclear Regulatory Commission
24 ("NRC") have failed to adequately address the environmental impacts of accidental radiological
25 leaks at Indian Point, including a failure to sufficiently consider how such radionuclides impact
26 the aquatic ecology of the Hudson River, and a failure to consider impacts related to a reasonably
27 foreseeable drinking water pathway in light of a proposed desalination facility to be located in
28 the direct vicinity of Indian Point.

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30

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1 **Q. What materials have you reviewed in preparation for your expert report and**
2 **testimony?**

3 A. I reviewed Riverkeeper and Clearwater Consolidated Contention, NRC Staff's FSEIS,
4 documentation related to United Water New York's proposed desalination project, several
5 documents identified as relevant to the contention by Entergy.
6

7 **Q. What conclusions have you reached about the impact of accidental radiological**
8 **leaks at Indian Point on the Hudson River?**

9 A. If there is present, past, or future leakage of radio-activity in the form of Sr-90, H-3, Cs-
10 137 or other isotopes from Indian Point into the waterway of the Hudson River, even low
11 activities of these materials will form a potential threat to the health of the local ecosystem via
12 dissolved and particulate exposure. Current research indicates that there is a linear, no threshold
13 response curve between human exposure to radioactivity and solid cancers. Further, there is
14 evidence that multi-celled organisms exposed to low doses of radiation can develop mutations
15 which are transmissible to offspring, indicating that leaks which happened in the past may still
16 affect organisms that rely on the Hudson River for food or water today or in the future. The fact
17 that Sr-90 has been found in fish tissue from the Hudson River and more than half of river water
18 samples, indicates that strontium represents a potentially harmful contaminant, as it is a known
19 carcinogen which accumulates in skeletal material and can cause bone and blood cancers. The
20 dissolved phase of Sr-90 can travel long distances on the tidal river (both north and south of the
21 source) and will most likely not be removed by traditional decontamination methods such as
22 filtration, coagulation, and clarification. Cs-137 would be expected to behave similarly, but does
23 not accumulate in organisms, making it more likely to travel long distances in the dissolved
24 phase and be difficult to remove from the water column. Both Sr-90 and Cs-137 have half-lives
25 of approximately 30 years and so can be expected to remain in the system for over 150 years or 5
26 half-lives. A careful study of the temporal and spatial distribution of these isotopes should be
27 conducted before water from the Hudson River is considered safe for human consumption.
28

29 **Q. Please describe your understanding of radiological leaks and groundwater**
30 **contamination at Indian Point.**

31 A. Based on my review of exhibits 33, 39, and 40 as well as the DEIS of the UWNY, it is my
32 understanding that at certain times groundwater from Indian Point is or has been highly

1 contaminated with radioactive isotopes from previous and possible ongoing leaks from fuel pools
2 and other sources, at levels exceeding state and federal drinking water standards. For the
3 radiological samples (Table 2.4 in Chapter 2 of DEIS), the samples were collected at various
4 locations throughout the Hudson River and not specifically at the outflow of the groundwater or
5 near Indian Point. Despite this fact, many samples were positive for radioactivity. Even though
6 average gross alpha and gross beta are below MCLs, some of the samples were higher than the
7 MCL. Specifically, the maximum alpha activity was 20pCi/L when the MCL is 15 pCi/L and the
8 maximum beta activity detected was 62 pCi/L when the MCL was 50 pCi/L. This fact can also
9 explain why the averages are relatively high (3.5 and 10.8 pCi/L respectively), even though
10 samples below detection were averaged as “zero” in the calculation. These high ranges of
11 radioactivity detected are likely due to leaks or flows via groundwater effluent into the Hudson
12 River.

13

14 Further, although the levels are low, Sr-90 was detected in more than half of the Hudson River
15 water samples. Therefore, more sampling needs to be done (both a time-series to verify temporal
16 variability and a transect to the North, South, and West to verify spatial variability) in the area
17 directly adjacent to Indian Point and to the intake location of the Proposed Project in Haverstraw
18 Bay. As far as Uranium, the indication is that it was found in all samples at low levels.

19

20 It appears undisputed that contamination in the groundwater migrates to the Hudson River;
21 Entergy has chosen to employ Monitored Natural Attenuation. This is not a satisfactory approach
22 because the long half-lives of the radionuclides involved (approximately 30 years for the
23 isotopes of Sr and Cs) mean this contamination released into the Hudson River through the
24 groundwater will pose a threat to the water quality of the river throughout the entire period of
25 extended operations of the proposed project in Haverstraw Bay, and requires more study before
26 it can be allowed to decay without treatment. Generally, radio-chemists use a very optimistic
27 benchmark of 5 half-lives to determine the residence time of isotopes in a system. With this in
28 mind, the Cs-137 and Sr-90 will be in the vicinity of Indian Point (and tidal waters north and
29 south) for at least 150 years. Further, new or continuous leaks would add new radio-isotopes to
30 the water column and thus would not contribute to natural attenuation.

31

1 **Q. What is understood about the pathways for fate and transport of this**
2 **contamination?**

3 A. The fate of radio-isotopes depends on the phase it is in: dissolved or particulate. Both Cs and
4 Sr are slightly particle reactive, generally on the order of 1000 times more concentrated on
5 particles than in the dissolved phase (IAEA TRS 190, 1976: Effects of ionizing radiation on
6 aquatic organisms and ecosystems). However, using the partition coefficients, K_{ds} , this still
7 results in the majority of the isotope to be found in the dissolved phase. In most cases, the
8 particulate phase is more dense than water and settles to the bottom of the water column or gets
9 ingested by organisms. The dissolved phase, on the other hand, can travel for long distances just
10 as the water in the river is constantly being flushed by the flood and ebb of the tide. The
11 residence time of the radio-isotopes in various locations of the River would be determined by the
12 flushing time of the water in that region and not by the radiological decay of the isotopes.

13

14 Another relevant influence on radioisotope distributions in river-estuarine systems
15 is suspended-sediment concentration. The activity of isotopes would tend to be lower in
16 the presence of high suspended-sediment concentrations (Benoit and Rozan, 1999). The
17 Hudson River is a highly turbid environment and thus there would be many opportunities
18 for the isotopes to sorb to particle surfaces and be removed from the dissolved phase.
19 However, in the Hudson there has been extensive dredging, most recently associated with
20 PCB clean-up. This has the potential to resuspend isotopes sorbed to sediments and re-
21 introduce them into the water column and ecosystem.

22

23 Once Sr-90 gets into organisms, it replaces calcium in bone due to their similar chemical nature.
24 This prevents the effective removal of the isotope from the body and strontium can accumulate
25 over time with low level chronic exposure. Cesium, on the other hand, forms a chloride
26 compound in the body and is water-soluble, thus is effectively flushed from organisms through
27 urine or sweat. Thus, while Cs-137 will not accumulate through food chains via trophic transfer,
28 there is a high potential that Sr-90 will. Humans could thus be exposed to Sr-90 at low levels by
29 drinking river water contaminated with the isotope, or by the consumption of fish which have
30 accumulated Sr-90 throughout their lifetimes.

31

1

2 **Q. The Hudson River is a tidal estuary as far north as the Federal Dam in Troy and**
3 **south into New York Harbor. How far will the radioactive isotopes leaking from Indian**
4 **Point travel?**

5 A. Because Sr-90 and Cs-137 are primarily found in the dissolved phase, they will travel
6 with the river water as far as the local water travels. According to the hydrological surveys, the
7 groundwater enters the river at depth. This will affect the distance the water travels since the
8 salty water travels more slowly up the bottom of the river than the freshwater travels seaward
9 along the river surface. Either way, there is nothing stopping the isotopes from travelling with a
10 parcel of river water.

11

12 However, while they travel, the parcel of water is being diluted by other river water and so the
13 concentration will decrease over time due to dilution. The rate of dilution will be faster than the
14 rate of radioactive decay, so this will limit the activity of the isotopes as they travel, but not the
15 distance they can travel. The only thing that would limit the distance traveled is adsorption onto
16 particles or uptake into organisms.

17

18 **Q. The NRC Staff stated in its FSEIS concerning the proposed license renewal of**
19 **Indian Point that “there is no drinking water exposure pathway to humans that is affected**
20 **by the contaminated groundwater conditions at the IP2 and IP3 site.”¹ How would you**
21 **respond to this statement?**

22 A. While that may currently be the case, it is my understanding that there is a proposed
23 project for a desalinization plant to be sited 5 miles downstream of Indian Point by United Water
24 New York, called Haverstraw Long-Term Water Supply Project. While the initial pilot project is
25 removing 144,000 gallons per day (at a rate of 100 gallons per minute to deliver approximately
26 100,000 gpd of potable water), the final completed plant would withdraw 10 million gallons of
27 water per day from the Hudson, which would yield 7.5 mgd of drinking water for Rockland
28 County residents.² As I understand, this project is currently in permitting phase; it is reasonably
29 foreseeable that it will come to fruition. This will result in water from the Hudson River right

¹ Indian Point FSEIS at 2-111.

² Haverstraw Water Supply Project DEIS, Draft EIS,
http://www.dec.ny.gov/docs/permits_ej_operations_pdf/uwnyfnlscope.pdf (Exhibit RIV000101); Pilot Study:
<http://haverstrawwatersupplyproject.com/project-facts/pilot-study.html>

1 near Indian Point being used for a drinking water source at some point during the proposed
2 extended operating terms.

3

4 **Q. Please summarize your opinions about the impact of accidental radiological leaks at**
5 **Indian Point on the Hudson River.**

6 A. In summary, I believe that Sr-90 and Cs-137 that are leaking into the Hudson River via
7 groundwater from the Indian Point Nuclear Facility pose a clear and imminent threat to both the
8 ecosystem of the Hudson River as well as potential contaminants for the desalinization plant
9 proposed by UWNYS in Haverstraw Bay. Because of the long half-lives of these isotopes and
10 their ability to travel long distances in the dissolved phase, they will easily be able to travel the
11 five miles to the intake point for the drinking water project. Low levels of exposure to these
12 radionuclides via drinking water or contaminated seafood have the potential to cause cancer in
13 humans. More sampling needs to be done to determine the extent of radiological contamination
14 in both time and space. The Sr-90, H-3, and Cs-137 leaks will need to be stopped and some
15 decontamination efforts will need to be taken before the water in the Hudson near Indian Point is
16 consistently safe for human consumption.

17

18 **Q. Does this conclude your initial testimony regarding Consolidated Contention RK-**
19 **EC-3/CW-EC-1?**

20 A. Yes.

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DECLARATION OF GILLIAN STEWART

I, Gillian Stewart, do hereby declare under penalty of perjury that my statements in the foregoing testimony and my statement of professional qualifications are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 C.F.R. § 2.304(d)



Gillian Stewart
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11367

December 22, 2011

ACADEMIC AND PROFESSIONAL HONORS

2010 – Present Appointed to Long Island Sound Study STAC
2006, 2007, 2008, 2010 Salute to Scholars, CUNY
2004 – 2005 American Association of University Women Dissertation Fellowship
1999 – 2004 Stony Brook Graduate Council Fellowship
1999 – 2002 Department of Defense National Defense Science and Engineering
Graduate Fellowship
2004 Sigma Xi Fellowship for Educational Travel
2004 Outstanding Student Poster Award at ASLO/TOS meeting, Honolulu HI
2003 Tinker Field Research Grant to conduct research in Spain
1999 – 2000 Okubo Award
1999 Stony Brook University Fellowship
1997 Derek Bok Teaching award for outstanding undergraduate teaching
1997 Phi Beta Kappa Society finalist
1994 – 1997 Agassiz prize every semester at Harvard
1994 – 1997 John Harvard award every semester at Harvard
1994 – 1996 National Merit Scholar

MEMBERSHIP IN PROFESSIONAL SOCIETIES

ASLO Minority Student Mentor (ASLOMP)
ASLO Early Career Committee Member
EUROceans North America Review Panel
GEOTRACES Inter-calibration Team
Fellow of the American Association of University Women
Member of the American Geophysical Union
Member of the American Society of Limnology and Oceanography (ASLO)
Member of the Society of Environmental Toxicology and Chemistry (SETAC)
Member of The Oceanography Society (TOS)
Member of the Women's Aquatic Network (WAN)
Junior Council member at the American Museum of Natural History
Member of the Stony Brook Center for Environmental Molecular Science
Member of the Sigma Xi Honor Society

SCHOLARSHIP AND CREATIVE WORK

(B) JOURNAL ARTICLES Indicate refereed journals with *.**1. Since most recent of: initial appointment, tenure, or last promotion.**

***Stewart, G.**, Moran, S.B., Lomas M., and Kelly, R.P. (2010) Direct comparison of ^{210}Po , ^{234}Th and POC particle-size distributions and export fluxes at the Bermuda Atlantic Time-series Study (BATS) site. *Journal of Environmental Radioactivity* doi10.1016/j.jenvrad.2010.09.011 90% writing, 70% data (invited)

***Stewart, G.**, Moran, S.B., and Lomas, M. (2009) Seasonal POC fluxes at BATS estimated from ^{210}Po deficits. *Deep-Sea Research I*, 57(1): 113-124 90% writing, 80% data

*Verdeny, E., Masqué P., Garcia-Orellana, J., Hanfland, C., Cochran, J.K., **Stewart, G.** (2008) POC export from ocean surface waters by means of $^{234}\text{Th}/^{238}\text{U}$ and $^{210}\text{Po}/^{210}\text{Pb}$ disequilibria: a comparison of two radiotracer pairs. *Deep-Sea Research II* 56: 1502-1518 50% writing, 40% data

*Engel, A., Abramson, L., Szlosek, J., Liu, Z., **Stewart, G.**, Hirschberg, D., Lee, C. (2008) Investigating the effect of ballasting by CaCO_3 in *Emiliana huxleyi*: II. Decomposition of particulate organic matter. *Deep-Sea Research II* 56: 1408-1419 25% writing, 35% data

*Cochran, J.K., Miquel, J-C., Fowler, S., Gasser, B., Hirschberg, D., Szlosek, J., Rodriguez y Baena, A.M., Armstrong, R., **Stewart, G.**, and Masqué, P. (2008) Time-series measurements of ^{234}Th in water column and sediment trap samples from the Northwestern Mediterranean. *Deep-Sea Research II* 56: 1487-1501 30% writing, 20% data

***Stewart G.M.**, J.K. Cochran, J. Xue, C. Lee, S. Wakeham, R.A. Armstrong, P. Masque, and J.C. Miquel (2007) Exploring the connection between Po-210 and organic matter in the northwestern Mediterranean. *Deep Sea Research I* 54: 415 – 427. 90% writing, 70% data

***Stewart G.M.**, P. Masque, J.K. Cochran, J.C. Miquel, J. Szlosek, A.M. Rodriguez, S.W. Fowler, B. Gasser, and D.J. Hirschberg (2007) Comparing POC flux estimates from $^{210}\text{Po}/^{210}\text{Pb}$ water column profiles with estimates from sediment traps and $^{234}\text{Th}/^{238}\text{U}$ profiles, 0-200 m northwest Mediterranean. *Deep Sea Research I* 54: 1459-1570 90% writing, 75% data

*Buesseler K., Benitez-Nelson C., Moran S. B., Burd A., Charette M., Cochran J.K., Coppola L., Fisher N., Fowler S., Gardner W., Guo L., Gustafsson O., Lamborg C., Masque P., Miquel J-C., Passow U., Santschi P., Savoye N., **Stewart G.**, Trull T., (2006) An assessment of particulate organic carbon to thorium-234 ratios in the ocean and their impact on the application of ^{234}Th as a POC proxy. *Marine Chemistry* 100: 213-233. 15% writing, 15% data

2. Prior to most recent of: initial appointment, tenure, or last promotion.

***Stewart G.M.**, S.W. Fowler, J.L. Tessyie, O. Cotret, and N.S. Fisher (2005) Contrasting the transfer of polonium-210 and lead-210 across three trophic levels in the marine plankton. *Marine Ecology Progress Series* 290: 27-33 85% writing, 90% data

*Liu X.F., **G.M. Stewart**, J.K. Cochran, C. Lee, R.A. Armstrong, D. Hirschberg, J.C. Miquel, and B. Gasser (2005) Constraints on the differences between POC measured in samples from Niskin

bottles and in-situ pumps. *Deep Sea Research I* 52(7): 1324-1344 75% writing, 30% data

***Stewart G.M.** and N.S. Fisher (2003) *Experimental studies on the accumulation of polonium-210 by marine phytoplankton. Limnology and Oceanography* 48(3): 1193-1201 90% writing, 90% data

***Stewart G.M.** and N.S. Fisher (2003) *Bioaccumulation of polonium-210 in marine copepods. Limnology and Oceanography* 48(5): 2011-2019 90% writing, 90% data

(C) CHAPTERS IN BOOKS/ANTHOLOGIES

1. Since most recent of: initial appointment, tenure, or last promotion.

Stewart, G. M., N. S. Fisher, and S. W. Fowler. Chapter 8: *Bioaccumulation of U/Th isotopes in marine organisms (2008)*, in *U/Th Series Radionuclides in Aquatic Systems*, S. Krishnaswami and J. K. Cochran, editors. Elsevier Press 85% writing, 50% data

(G) ORAL PAPERS AND ADDRESSES

(Indicate whether addresses were "refereed (*)," or "invited (**)." In case of joint presentations, indicate presenting author by # sign.)

1. Since most recent of: initial appointment, tenure, or last promotion.

**CUNY Environmental Forum, November 2010 –gave dust talk, Jim presented poster on Copper in East River

*Jim and Vadim talks at ASLO in San Juan, Puerto Rico, February 2011

*Jim's Talk at LISF meeting, Stamford CT October 2010

Arctic GEOTRACES Planning Meeting, NSF, Washington D.C., September 2010. "Exopolymeric substances, POC flux, and short-lived natural radionuclides (^{210}Po , ^{234}Th) in the Arctic" **Stewart#

SEES Colloquium, Queens College, CUNY, September 2010 "Climate Change and Decadal Changes of Zooplankton Community in Long Island Sound." Rice, E.J#, **Stewart, G.**

** ^{210}Po and ^{210}Pb in the Environment, Sevilla Spain October 2009 "Accumulation of ^{210}Po and ^{210}Pb in Marine Organisms." **Stewart#**

*Chemical Oceanography Gordon Research Conference, Tilton, NH, August 2009

"Size fractionated ^{210}Po and ^{210}Pb data confirms association with sinking organic matter under oligotrophic conditions at Bermuda Atlantic Time Series site (BATS)." **Stewart#**, Moran, Lomas

*ASLO Aquatic Sciences Meeting, Nice, France, January 2009

"Deficit of Po-210 predicts POC flux at BATS from winter through spring." **Stewart#**, Moran, Lomas

*ASLO Aquatic Sciences Meeting, Nice, France, January 2009

"Examining the effect of mesoscale eddies on particle flux using ^{234}Th and ^{210}Po ." Verdeny#, Masque, Benitez-Nelson, **Stewart**, Villa

*ASLO Ocean Sciences Meeting, Orlando FL, March 2008

"The cellular distribution of phytoplankton Po and Pb and zooplankton vertical migration."

Stewart#, Masque, Verdeny and Tovar-Sanchez

*ASLO Ocean Sciences Meeting, Orlando FL, March 2008 – ASLO Minority Student Symposium
“The natural radionuclides Po and Pb as tracers of circulation in Long island Sound” Leon#,
Stewart, Marchese

*ASLO Ocean Sciences Meeting, Orlando FL, March 2008
“Medflux: Using 3D plots from principal component analysis to visualize degradation trajectories
of organic matter.” Xue#, Armstrong, Lee, Liu, Wakeham, Goutx, **Stewart**

**Marine Sciences Colloquium, University of South Carolina, Columbia SC, February 2008 “The
marine biogeochemistry of polonium-210 in estuaries and coastal systems,” **Stewart**

*Gordon Conference, Chemical Oceanography, Tilton NH, August 2007
“Po and Pb dynamics off the Canary Islands; Insights into eddies,” **Stewart#**, Masque, and
Verdeny

**Brookhaven Radionuclides and Environment Symposium, New York July 2007
Invited talk “Po-210 and Pb-210: Novel Tools to Connect Ecosystems and Aquatic
Biogeochemistry,” **Stewart**

**CIESM Bi-annual Congress, Istanbul Turkey April 2007
Invited talk (sent poster instead) “Particle composition, sinking rate, and organic carbon at the
DYFAMED site in the NW Mediterranean,” **Stewart#**, Cochran, Lee, Wakeham, Armstrong and
Masque

10th Annual Urban University Conference, City College CUNY April 2007
Two student posters presented: Lily Leon, Latisha Williams

**Rutgers University, Institute of Marine and Coastal Studies, New Brunswick NJ February 2007
Invited talk “Uranium series isotopes as carbon tracers in the ocean,” **Stewart**

**Hunter College, CUNY Geography Department, NY November 2006
Invited talk “Polonium to lead ratios describe trophic roles in marine planktonic systems,”
Stewart

*American Geophysical Union Fall Meeting, San Francisco, December 2006.
“The roughage effect of dust on carbon assimilation in grazers, and potential implications for
atmospheric CO₂” **Gillian Stewart#**, Karen Kohfeld, Andreas Schmittner, Zanna Chase, Adina
Paytan, Andy Ridgewell

*Annual Biomedical Research Conference for Minority Students (ABRCMS), Anaheim CA,
November 2006. “Chemical and Geological Effects on Abundance and Distribution of
Macrobenthos in Western Long Island Sound” Maria Rosa#, **Gillian Stewart**, Cecilia McHugh,
Marie-Helene Cormier

*Long Island Sound Meeting, New London October 2006 “Can Natural Radionuclides Recognize
the Extent of Hypoxia in Western Long Island Sound?” Lily Leon#, **Gillian Stewart**, Cecilia
McHugh, Paul Marchese, and Yan Zheng

*AGU and ASLO Ocean Sciences Meeting, Honolulu February 2006

** Minority Student Mentor for this meeting***

**Comparing ²¹⁰Po/²¹⁰Pb ratio profiles in samples from sediment traps, in situ pumps, and
Niskin bottles during MEDFLUX: An investigation of mesopelagic remineralization and

scavenging" **G. Stewart**#, P. Masque, K. Cochran, J. Miquel, B. Gasser, D. Hirschberg, A. Rodriguez y Baena, S. Fowler

*AGU and ASLO Ocean Sciences Meeting, Honolulu February 2006

"Importance of Calcareous Shells in Aggregate Formation and Particle Decomposition for the Coccolithophore *Emiliana Huxleyi*" A. Engel#, J. Szlosek, L. Abramson, Z. Liu, **G. Stewart**, D. Hirschberg, C. Lee

*AGU and ASLO Ocean Sciences Meeting, Honolulu February 2006

"MEDFLUX: Particulate Organic Carbon –Th234 Relationships in Particles Separated by Settling Velocity in the Northwest Mediterranean" J Szlosek#, J.K. Cochran, J.C. Miquel, S Fowler, B. Gasser, D. Hirschberg, P. Masque, **G. Stewart**, A. Rodriguez y Baena, T. Toubal

Women In Science Conference, Queens College, NY November 2005

First author poster "The biogeochemistry of Polonium 210 and implications for its use as a tracer," **Stewart**

New York Nature Conference, Queens College, NY December 2005

First author poster "Using radionuclides to trace organic contaminants in the Hudson River Estuary" **Stewart**

**Queens College, CUNY Biology Department Colloquium, October 2005

Invited talk "Accumulation of Po-210 and Pb-210 in marine planktonic systems"

2. Prior to most recent of: initial appointment, tenure, or last promotion.

*2005 DISCO XIX (Dissertation Symposium on Chemical Oceanography) Sponsored by NSF and NOAA (Kona, HI) "The Biogeochemical Cycling of Polonium-210 in the Ocean."

*2005 American Society of Limnology and Oceanography Summer Meeting (Santiago de Compostela, Spain) "Particle composition and polonium-210 and lead-210 content in the MEDFLUX study: Implications for the use of Po as a tracer of particle flux," **Stewart**#, Cochran, Masque, Lee

2004 Center for Environmental Molecular Science's "Brown-bag Lunch" seminar series (Stony Brook, NY) "Environmental Applications of ²¹⁰Po." **Stewart

2004 Queens College School of Earth and Environmental Science (Flushing, NY) Wednesday Colloquium. "Polonium, Plankton, and Carbon Flux – Oh My!" **Stewart

2004 "Wally's Seminar Series" at Lamont-Doherty Earth Observatory (Palisades, NY) "The Biogeochemistry of ²¹⁰Po in Surface Waters." **Stewart

*2004 International Commission for the Scientific Exploration of the Mediterranean Sea meeting (CIESM) Barcelona, Spain: "The bioaccumulation of ²¹⁰Po in plankton and its potential use as an organic carbon tracer at the DYFAMED site in the Northwestern Mediterranean" and "²¹⁰Po and ²¹⁰Pb concentrations, fluxes, particle settling velocities, and organic carbon at the DYFAMED Site, Northwestern Mediterranean" **Stewart**# et al.

*2004 American Society of Limnology and Oceanography / The Oceanography Society's Ocean Science meeting (Honolulu, HI): "MEDFLUX: ²¹⁰Po as a tracer for organic carbon in the Northwest Mediterranean" **Stewart**#, Masque, Fisher, and Cochran. **Outstanding

*2004 Center for Environmental Molecular Science Graduate Student Conference (Stony Brook, NY): “²¹⁰Po concentrations and fluxes at the DYFAMED site, Northwestern Mediterranean” **Stewart#**, Masque, Armstrong, Lee and Cochran. **One of ten organizers of the meeting.

*2003 American Society of Limnology and Oceanography’s Aquatic Science meeting (Salt Lake City, UT): “Radioactive polonium, lead, and thorium as tracers of organic carbon flux in the surface ocean” **Stewart#**, Cochran, Fisher, Lee

*2002 American Society of Limnology and Oceanography’s summer meeting (Victoria, B.C): “Uptake and trophic transfer of polonium in marine plankton.” **Stewart#**, Fisher, and Baines

(H) REPORTS AND OTHER WORKS.

1. Since most recent of: initial appointment, tenure, or last promotion.

Summary of the Jamaica Bay BioBlitz 2007:

<http://www.nps.gov/gate/jamaica-bay-bioblitz.htm>

Update from the Early Career Committee.

Limnology and Oceanography Bulletin, Volume 17 (2) June 2008, p. 52-55

Assessment of Coastal Water Resources and Watershed Conditions in Gateway National Recreation Area, NY/NJ.

Report of the NPS, DOI Water Resources Division and Natural Resources Program.
Technical Report NPS/NRWRD/NRTR -2008/XXX

Assessment of Coastal Water Resources and Watershed Conditions in and around Fire Island National Seashore, NY.

Report of the NPS, DOI Water Resources Division and Natural Resources Program.
Technical Report NPS/NRWRD/NRTR -2007/XXX

Assessment of Coastal Water Resources and Watershed Conditions in Sagamore Hill National Historic Site, NY.

Report of the NPS, DOI Water Resources Division and Natural Resources Program.
Technical Report NPS/NRWRD/NRTR -2007/XXX

2. Prior to most recent of: initial appointment, tenure, or last promotion.

Stewart, G.M., N.S. Fisher, J.K. Cochran, S.W. Fowler, and P. Masqué (2004) The bioaccumulation of ²¹⁰Po in plankton and its potential use as an organic carbon tracer at the DYFAMED site in the Northwestern Mediterranean. *Rapp. Comm. Int. Mer. Medit.* 37: 245.

Stewart, G.M., J.K. Cochran, P. Masqué, R.A. Armstrong, J.-C. Miquel, A. Rodriguez, S.W. Fowler, M. Peterson, and N.S. Fisher (2004) ²¹⁰Po and ²¹⁰Pb concentrations, fluxes, particle settling velocities, and organic carbon at the DYFAMED site, Northwestern Mediterranean. *Rapp. Comm. Int. Mer. Medit.* 37: 246.

Benitez-Nelson, C. and the participants of FATE 2004 Future Applications of ^{234}Th in Aquatic Ecosystems (FATE) (2004) EOS 85 (45):471-472.

Environmental Science on the Web: Interactive Exercises for Environmental Science

(8/2001 – 12/2002) Wrote three chapters and exercises for Environmental Science textbook geared towards advanced high school and introductory college students:
<http://www.webschoolofscience.com/EnvScience.htm>

(I) SUBMITTED WORKS AND WORK IN PROGRESS. Specify stage of progress and magnitude of work. Include number of manuscript pages for each submitted work.

Manuscripts in Progress:

Low temperature samples bias results of counts of marine phytoplankton using a Coulter Counter Multisizer III. (Accepted with major revisions, Summer 2011). Rice, E.J., Panzeca, C., and **Stewart G.** *Marine Ecology Progress Series*

Assimilation, subcellular partitioning and accumulation of elements by grass shrimp pre-exposed to dietary metal. (In Review, May 2011) Seebaugh DR, Wallace WG, **Stewart GM.** *Aquatic Toxicology*

The roughage effect of dust on carbon assimilation in grazers, and potential implications for atmospheric CO₂, (submitted to Geophysical Research Letters). **Stewart, G.,** Kohfeld K., Schmittner A., Chase Z., Paytan A., and A. Ridgwell. 8 pages, 2 figures, 1 table (Plan to resubmit to Global Biogeochemical Cycles, waiting for new data from co-authors, writing 85% complete)

(1) Grants in Progress
Research

EXTERNAL

IGERT: Returning the Radio to Chemistry: Integrating Radiochemistry into a Chemistry Ph. D. Program. NSF IGERT CHEM (09/01/10 – 08/31/15) \$3,000,000, approx. \$150,000 to QC CUNY, PI: Franscesconi. Stewart would be a “non PI major participant”

Collaborative Research: GEOTRACES – Application of ²¹⁰Pb and ²¹⁰Po distribution at North Atlantic interface regime NSF OCE (1/1/10 -12/31/12) \$287,887 PI: Church, Co-PIs: Stewart and Baskaran

*Collaborative Proposal: Testing linkages between plankton community structure and export of C, Po, and Th: Field and Lab Experiments in the NE Subarctic Pacific NSF OCE (1/1/10 – 12/31/12) \$799,713 PI: **Stewart**, Co-PIs: Moran and Lomas*

INTERNAL (CUNY)

SEES SAW (\$38K) GRTI14

*Hypoxia, Toxic Substances and Living Resources in the Bays and Basins of Western Long Island Sound (WLIS), CUNY Research Enhancement Initiative, \$6600 PI: **Stewart** co-PI: Zheng*

The Impact of Phytoplankton Diet on Copepod Reproduction, QC Undergraduate Research/ Mentoring Education Initiative, \$1180 PI: Stewart, Student: Jennifer Nyirucz

(2) Grants Completed
Research

EXTERNAL

*The Roughage Effect of Mineral Material on Marine Grazers: Potential Implications for the Global Carbon Cycle ACS PRF (01/01/08 – 12/31/09) \$50,000 PI: **Stewart***

Long Island Sound Study Science and Technology Advisory Committee Fellowship NY SeaGrant (10/09 – 09/10) \$19,500 PI: Stewart, Fellowship to Edward Rice

*Assessment of natural resources and watershed conditions in and/ adjacent to Gateway National Recreation Area, Sagamore Hill National Historic Site, and Fire Island National Seashore National Park Service USGS (6/01/06 – 12/31/07) \$12,200 to CUNY PI: McElroy, CoPIs: Waldman, Swanson, Bennotti, **Stewart***

Collaborative Research-Track 1: Partnership to Enhance Diversity in Marine Geosciences: Holocene Climate and Anthropogenic Changes in Long Island Sound, NYNSF GEO, (5/15/05 to 5/14/07) \$59,819 with co-PIs C. McHugh, Y. Zheng, M. Cormier, P. Marchese

Remolinos Oceanicos y Deposicion Atmosferica (RODA) en el Corriente de Canarias (Atlantico Este subtropical): monitorizacion, efectos biologicos y biogeoquimicos, y flujos hacia el ocean profundo MEC Spain (11/28/05 to 12/01/08) ~\$7,500 to CUNY with co-PIs Javier Aristegui Ruiz, Pere Masque, and Susana Agusti.

Seafloor mapping and habitat assessment of Western Long Island Sound ENTERGY (6/06 – 6/07) \$30,000 with co-PIs Cecilia McHugh and Marie-Helene Cormier

Jamaica Bay BioBlitz Jamaica Bay Institute, Gateway National Recreation Area and North Atlantic Coast CESU (8/01/06 – 9/30/07) \$9987 PI: **Stewart**, CoPI: Waldman

INTERNAL (CUNY)

The impact of changing particle loads on the assimilation of trace metals by marine copepods, PSC CUNY 39 (6/1/08 – 3/31/09) \$6000 PI: **Stewart**

The impact of changing particle loads on the assimilation of carbon by marine copepods: an enhanced biological pump or collapse of marine grazers? CUNY Collaborative Incentive (9/01/07 – 8/31/08) \$38,995 PIs **Stewart**, co-PI: Wallace

Mineral Dust Controls on Carbon Export in Marine Ecosystems. Queens College Research Enhancement Initiative 2007, \$20,000 (to purchase Coulter Counter) PI: **Stewart**

Investigating the relationship between PCB bioconcentration and the natural radio-tracer polonium-210 in Hudson River plankton PSC CUNY (7/01/06 - 9/30/07) \$6000 PI: **Stewart**

Elemental analysis of CHNS-O in Terrestrial and Marine Ecosystems Queens College, CUNY Research Award (6/01/07) \$15,720 CoPIs: Bird, **Stewart**, McHugh

William Stewart Travel Award CUNY Stewart Foundation (5/1/06) \$300 **Stewart**

(3) Grants Submitted, but not Funded Research

EXTERNAL

LISS/EPA: Size and Species Diversity Changes in Long Island Sound Copepods as Sentinels of Climate Change (3/01/11 – 3/01/13) \$90,400 PI: Stewart

An Earth Systems-based approach to improve teacher and student understanding of hydrosphere-atmosphere-biosphere interactions: Authentic research in an urban mini-estuary, NOAA \$737,482 PI: Ludman Co-PI: **Stewart**, Eaton

Mitigation of Western Long Island Sound Hypoxia by Reduction of Loadings from Embayments, NFWF Dissolved Oxygen Environmental Benefit \$189,668 PI: Zheng Co-PI: **Stewart**, Eaton, Rukovets, Sattler, Nichols

Climate Change induced shifts in plankton dynamics in Long Island Sound: Implications for fisheries management **Long Island Sound Study (EPA, NOAA)** \$67,500 CoPIs:

Stewart and Waldman

Collaborative Proposal: Testing linkages between plankton community structure and export of C, Po, and Th: Field and Lab Experiments in the NE Subarctic Pacific **NSF OCE** (2/1/09 – 1/31/12) \$1,383,713 PI: **Stewart**, CoPIs: Moran and Lomas

Collaborative Research: Mineral Dust Controls on Carbon Cycling and Export by Marine Ecosystems: Impact on Atmospheric CO₂ **NSF OCE Carbon and Water** \$2,391,100 CoPIs: Kohfeld, **Stewart**, Schmittner, Chase, Ridgwell, Payton

Inter-annual Variability and Rapid Oscillation of Hypoxia in Western Long Island Sound and the Surrounding Bays **National Oceanic and Atmospheric Administration** (12/1/07 – 11/30/12) \$1,201,887 PI: Zheng, CoPIs: **Stewart**, Eaton, Swanson, Wilson, Rukovets

Collaborative Proposal: Testing linkages between plankton community structure and export of C, Po, and Th in the Sargasso Sea **NSF OCE** (2/1/08 – 1/31/11) \$383,713 PI: **Stewart**, CoPIs: Moran and Lomas

Collaborative Research: Testing linkages between plankton community structure and export of C, Po, and Th in the Sargasso Sea; Field and lab experiments **NSF CHEM OCE** (6/1/08 – 5/31/11) \$462,232 PI: **Stewart**, Co-PI: Brad Moran

The roughage effect: The influence of atmospheric dust on carbon assimilation, packaging, and sinking in marine plankton **NOAA Global Carbon Cycle FY2007** (5/1/07 – 4/31/10) \$233,000 PI: **Stewart**

Hypoxia, Toxic Substances and Living Resources in the Bays and Basins of Western Long Island Sound **National Fish and Wildlife Foundation, Long Island Sound Anoxia Fund** (4/1/07 – 3/31/08) \$187,000 PI: Zheng, Co-PIs: **Stewart**, Eaton, IEC

Western Long Island Sound benthic habitat classification and mapping **EPA**. \$160,000 CoPIs: McHugh, **Stewart** and Cormier

Using natural radiotracers to add a timestamp to organic contaminant uptake by organisms: PCBs in the Hudson River **New York SeaGrant** \$143,000 PI: **Stewart**

INTERNAL (CUNY)

Climate Change Induced Shifts in Phytoplankton Dynamics of Long Island Sound, PSC-CUNY 40. \$6000 PI: **Stewart**

Mineral Dust Controls on Carbon Export in Marine Ecosystems **Research Enhancement Proposal, Graduate Center CUNY** \$66,258 coPIs: **Stewart** and Bird

SERVICE

(A) COLLEGE/UNIVERSITY.

Department

Fall 10 – GRTI funding

Summer 10, Summer 11 – Acting Chair of SEES

Fall 09 – Ran informal search for substitute lecturer for Ensci 100

Spring 09 – Elected to SEES Personnel and Budget Committee

Spring 09 – Attended NSF sponsored Workshop in “Strengthening Geosciences Departments”

Spring 08 – SEES Faculty Search Committee

Spring 08 – Development of PLAS Ensci 100

Fall 07 – Coordinated SEES Colloquium Series

Spring 06 – Coordinated SEES Colloquium Series

Spring 06 – On committee (with Hendrey and Kohfeld) to develop Earth System Science/
Biogeochem sub-program within SEES

Queens College

Fall 10 – appointed to LISS STAC

Fall 08 – present Alternative Representative for QC to NY Marine Sciences Consortium

Spring 09 – Strategic Planning Committee for plan #8: Increase strength of sciences at QC

Fall 08 - present – QC Academic Senate (Divisional Rep.)

Fall 06 - Spring 08 – QC Academic Senate (Departmental Rep.)

CUNY

Spring 11 – Macauley College Council

Spring 09 – CIRG, CUNY Collaborative Review Panel

Fall 08 - present EES Admissions Committee

Fall 07 - present EES Executive Committee

Mentoring

Undergraduates

2010-: Annakerina Marinos, QC Undergrad (Diatom toxicity to Copepods)

2009- : Vadim Acosta, QC Undergraduate/prospective MA student (Trace metal analysis)

2009- : Nathalie Diaz, QC Undergraduate (Lab maintenance, Fecal pellet decomposition)

2008- :Jennifer Niyruz, CUNY Honors College student (Dust and reproduction in copepods)

2008- :Raquel Henry-Singh, QC undergraduate (Lab maintenance, plankton growth)

2008- :Elizabeth Bisbee, QC undergraduate (Lab maintenance, Coulter Counter)

2008- :Richard Bubbico, QC undergraduate (Lab maintenance, copepod feeding experiments)

2006-2008: Bonnie Quach Wong, Bronx Science student doing an INTEL project (Hudson River)

2006-2007: Luis Deverez, QC Geology major working in lab (Phytoplankton cultures)

2006: Maria Rosa, CCNY Biology student working in lab (Diversity and hypoxia in WLIS)

2006-2007: Latisha Williams, QC Ensci major working in lab (Oxygen and benthos in WLIS)

Graduate Students

Lily Leon, QC Geology Masters, Po/Pb in WLIS, graduate 5/09

YiYi Wong, EES Ph.D. Thesis Advisor 7/09 – 7/10

Vadim Acosta, MA...

Yan Choi, MA...

Jim Rice, QC SEES Ph.D., Thesis Advisor 9/08 –

Dustin Herlich, QC SEES Ph.D., Thesis Advisor 9/07 -

Caitlyn Nicholls, CSI Biology Ph.D., Thesis Committee 9/08 -

David Seebaugh, CSI Biology Ph.D., Thesis Committee 8/07 -

Tiffany Johnson, QC Biology Ph.D., Thesis Committee 5/07 -

Katherine Paccione, QC Biology Masters student, Thesis Committee, graduated 5/09

(B) PROFESSION.

Session Coordinator

2011 Chaired Session on Multiple POC proxies at ASLO (San Juan)

2009 Chaired Session on Short-lived Natural Radionuclides at ALSO (Nice, France)

2005 – 2009 Expand Your Horizon Conference (Annual), Workshop Leader (NY, NY)

2006 Minority Student Mentor at ASLO Ocean Sciences Meeting (Honolulu, HI)

Reviewer

Member of Arctic Research Panel for NSF (BEST, June, 2007)

Member of Chemical Oceanography Panel for NSF (November, 2009)

Funding Agencies – EUR-Oceans, National Science Foundation (~12 Chem Oce., ~6 Polar Prog., ~7 Bio. Oce.)

Refereed Journals – *Deep-Sea Research, Limnology and Oceanography, Marine Ecology Progress Series, Marine Chemistry, Coastal Estuarine and Shelf Research, Journal of Marine Research, Journal of Food Composition and Analysis, etc.*

EUROceans Graduate and Post Doc Selection Committee 2007

College of Reviewers for Canada Research Chairs Program 2008

CIRG CUNY Collaborative Proposal Review Panel 2009

Committee Member

LISS STAC

ASLO Early Career Committee

GEOTRACES Intercalibration Team

Oceanographic Research Cruise Experience

Line P cruises (and planning meetings)

GEOTRACES North Atlantic Cruise

WLIS Cruise June 2006

RODA Canary Island Cruise August-Sept 2006

(C) COMMUNITY. *Last five years only.*

Invited to talk at Stony Brook Recruiting event March 2011

Invited to talk and co-host at Macaulay Honors College Event April 2011

Invited to participate in Jamaica Bay Education Coordinating Committee

Jamaica Bay BioBlitz: Coordinate and manage a 24 hour species inventory of the 25,000 acres in Jamaica Bay. Brought together scientists, experts, naturalists, educators, outreach groups, volunteer organizations and the public for a celebration of the diversity in our own “backyard.”

<http://nbii-nin.ciesin.columbia.edu/jamaicabay/bioblitz/BioBlitz.html>

Expand Your Horizons: Session coordinator yearly since 2006 for a public program to engage 7th grade girls in math and science. Sponsored by the American Association of University Women.

<http://www.aauw-eyhconference.com/index.htm>

Globe Program: May 2008, gave lectures on Climate Change and conducted hands-on activity for 27 NYC Public School teachers through the Globe Project.

CUNY Week: 2006, 2007, gave lectures to 60+ local Queens seventh graders about Biodiversity as part of CUNY Week activities.