

Activity 31 – Science and Modern History (Sept 11, 2001)

Science-related impacts due to terrorist attack on Twin Towers

Prior to beginning a review of this assignment's expectations, objectives, and assignment instructions, students should become familiar with general facts of the events preceding, during, and following the terrorist attacks take against the United States of America on September 11, 2001.

Below are examples of resources for students to gain broader perspectives than offered in this science assignment.

Video: 2:11 Being a Child on September 11, 2001

<https://youtu.be/U6gJWyGxAVA>

Video: 5:09 Students learn about Sept. 11, 2001

https://youtu.be/oj-u5N5N_d0

Video: 8:59 Sept 13 2001 downtown Manhattan, New York

<https://youtu.be/Ajc7jWKya50>

Article: September 11 attacks – Wikipedia

https://en.wikipedia.org/wiki/September_11_attacks

Acknowledgement toward this topic deserves sensitivity and should be approached with the gravity and significance the attack had – *and still has* – world-wide. The scope of this assignment presumes students have already been appropriately introduced and familiarized with the broader subject of the terrorist attacks committed. This assignment would otherwise risk the appearance of (i) diminishing the tragedy in terms of loss of human life; (ii) ignoring the topic of terrorism; (iii) excluding the importance of politics, religion, and economics, and (iv) over-looking important implications found in sociology and many other similar subjects. **This assignment in no way intends to diminish these important subject areas as other lenses to view the tragic event.**

This assignment intentionally focuses on impacts of the attack in terms of natural science. Rationale for doing so serves two purposes: (1) History classes, in particular – *and, in contrast to science classes* - offer superior ways to review the attacks in a broad context; and (2) narrowing the scope to focus explicitly through the lens of science allows students to more deeply internalize the broader subject in a specific manner.

Instructions

Upon direction from your instructor, form small teams of 2-3 people each, or perform this assignment as an individual. This assignment is estimated to require a minimum of two days to complete with a probable four days to fully complete. Below, find a comparison of 2, 3, and 4 day “projects.”

Action	2 day (paper only)	3 day (paper only)	4 day (paper + PPT)
Select topic	Day 1	Day 1	Day 1
Begin research	Day 1	Day 1	Day 1
Continue research	Day 2	Day 2	Day 2
Develop draft <i>paper</i>	Day 2	Day 2	Day 2
Submit draft <i>paper</i>	Day 2	Day 2	Day 2
Improve draft <i>paper</i>		Day 3	
Finalize draft <i>paper</i>		Day 3	
Submit final <i>paper</i>		Day 3	
Develop presentation			Day 3
Submit presentation			Day 3
Present			Day 4

The outcome (deliverable) of a two day assignment is a DRAFT form research paper. For a three day assignment, the deliverable is a well formatted, well sourced/referenced research paper. For a four day assignment the deliverables are a DRAFT research paper, a final form PowerPoint presentation, and a presentation of the material to the class.

1. Select a topic
2. Review the timeline and work to meet the timeline show
3. Keep track of sources of information as the research progresses
4. Avoid copy/paste plagiarism
5. Make use of high-school level ELA methods for developing and improving the paper
6. Aim for a 5 minute presentation (for the 4-day path)
7. Submit all deliverables on time

Suggested Topics for Individual Students (or, Small Student Teams)

Chemistry as part of the Life and Physical Sciences

Explore the subject area (in-general) of a topic listed below. Extend ideas, concepts, technologies, and related information to the events of September 11, 2001.

For example, chemical components of air samples are often instructive to scientists for a wide range of reasons. Air sampling was performed post 9/11.

- High-altitude imaging and modeling of the atmospheric plume
- Analyses of outdoor and indoor settled dust
- Prospective epidemiologic studies
- Inhalation studies of dust by mice
- Ambient air sampling
- Clinical examinations

Life and Biological Sciences

Explore the subject in terms of the impacts on living things – including vegetation, small animals, domestic animals, and human life. Identify health-related implications of the events.

- Impacts on plant life near and around ground zero
- Impacts on domestic animals (dogs, cats)
- Impacts on humans
- Impacts on rodents
- Impacts on insects

Earth and Environmental Science Topics (Air Pollution)

Explore the subject in terms of the impacts resulting from air pollution.

- Research and report on the “*Three-day assessment of ‘clear skies’*” following the catastrophe through the absence of contrails in the atmosphere due to the grounding of aircraft
- Compare/contrast “the plume” to volcanic eruption – and effects on air quality
- Compare/contrast “the plume” to naturally occurring forest fires – and effects on atmosphere
- Compare present day NY city air quality with pre-911 air quality

Earth and Environmental Science Topics (Water Issues)

Explore the subject in terms of the impacts resulting from water issues – ground water, drinking water, subsequent precipitation, and near-by brackish water sources.

- Ways to triage and dispose of massive amounts of waste due to unforeseen circumstances
- Impacts on wildlife due to significant increased alkalinity on fresh water sources
- Emergency responses to large-scale disasters (clean-up and land remediation)
- Impacts on humans due to significant increased alkalinity on drinking water

- Safety equipment required for large-scale environmental cleanup

Partial Extracts, Context, and Background Information

Below, find high-level abstracts and summaries of some information related to this assignment from a science-perspective. These samples are far from being comprehensive. Rather, they provide a starting place for students to begin their research or by identification of a specific interest area.

Health and environmental consequences of the world trade center disaster.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241968/>

- Environ Health Perspective. 2004 May; 112(6): 731–739.
 - doi: 10.1289/ehp.6702
 - PMCID: PMC1241968
 - PMID: 15121517
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The attack on the World Trade Center (WTC) created an acute environmental disaster of enormous magnitude.

WTC dust was found to consist predominantly (95%) of coarse particles and contained pulverized cement, glass fibers, asbestos, lead, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and polychlorinated furans and dioxins.

Airborne particulate levels were highest immediately after the attack and declined thereafter.

Particulate levels decreased sharply with distance from the WTC.

Dust pH was highly alkaline (pH 9.0-11.0).

Mice exposed to WTC dust showed only moderate pulmonary inflammation but marked bronchial hyperreactivity.

Evaluation of 10,116 firefighters showed exposure-related increases in cough and bronchial hyperreactivity.

Evaluation of 183 cleanup workers showed new-onset cough (33%), wheeze (18%), and phlegm production (24%).

Increased frequency of new-onset cough, wheeze, and shortness of breath were also observed in community residents.

Follow-up of 182 pregnant women who were either inside or near the WTC on 11 September showed a 2-fold increase in small-for-gestational-age (SGA) infants.

In summary, environmental exposures after the WTC disaster were associated with significant adverse effects on health.

The high alkalinity of WTC dust produced bronchial hyperreactivity, persistent cough, and increased risk of asthma. Plausible causes of the observed increase in SGA infants include maternal exposures to PAH and particulates.

Future risk of mesothelioma may be increased, particularly among workers and volunteers exposed occupationally to asbestos. Continuing follow-up of all exposed populations is required to document the long-term consequences of the disaster.

Examples of Testing and Data Gathering for findings listed above

- ambient air sampling
- analyses of outdoor and indoor settled dust
- high-altitude imaging and modeling of the atmospheric plume
- inhalation studies of WTC dust in mice
- clinical examinations
- community surveys
- prospective epidemiologic studies

Human Health (Biology)

<https://www.ncbi.nlm.nih.gov/pubmed/16809158>

In the aftermath of the September 11 World Trade Center (WTC) attack, a large number of people sustained potential exposures to smoke, dust, particulate matter, and a variety of toxins, including asbestos, pulverized concrete, glass fibers, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated furans and dioxins. Additionally, many had exposure to psychological traumatogens. The most common effects seen to date are respiratory and mental health consequences. The long-term consequences of exposures are not yet known, and there remains concern about the potential for late-emerging diseases such as cancers. This article reviews WTC-related health effects, the spectrum of exposures and how they were documented, and discusses future preventive efforts.

Animal Health and Food Chain (Biology)

- Impact of the food chain within New York City (beginning with mice)

General Ecological Impacts (Earth & Environmental Science)

<https://www.nrdc.org/sites/default/files/wtc.pdf>

AIR POLLUTION

The fires and collapse of the World Trade Center that followed the terrorist attacks of September 11th created an unparalleled, high-intensity pollution discharge.

The improvements in air quality since September 11th and the first days and weeks thereafter are dramatic. They are likely due to the passage of time since the collapse itself.

Pollution “hot spots” remained for weeks and months following the event.

One issue regarding air pollution was the city’s air quality monitoring network.

<https://youtu.be/NDn6m31DWkl>

Possible Earth and Environmental Science Topics (Air Pollution)

- Research and report on the “*Three-day assessment of ‘clear skies’*” following the catastrophe through the absence of contrails in the atmosphere due to the grounding of aircraft
- Compare/contrast “plume” to volcanic eruption – and effects on air quality
- Compare/contrast “plume” to naturally occurring forest fires – effects on atmosphere
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WASTE DISPOSAL AND WATER ISSUES

Among its other unprecedented consequences, the collapse of the World Trade Center created a monumental waste disposal and cleanup challenge

At Fresh Kills, hundreds of sanitation workers and law enforcement officials have been on hand to manage the Trade Center debris. In general, cranes have first separated out large objects, such as crushed cars and trucks, which are recycled if possible. The remainder is dumped into piles on the ground, or placed on conveyer belts or sifters, for inspection by police officers and federal agents in full protective gear.

The reopening of the Fresh Kills landfill as a repository for World Trade Center wastes has raised several environmental and public health concerns. One issue involves the safety of the hundreds of workers at the site. According to Sanitation Department employees, some workers were not wearing proper safety gear, including respirators, jumpsuits and boots, during the first several weeks of the Fresh Kills operation.

Possible Earth and Environmental Science Topics (Water Issues)

- Impacts on humans due to significant increased alkalinity on drinking water
- Impacts on wildlife due to significant increased alkalinity on fresh water sources
- Ways to triage and dispose of massive amounts of waste due to unforeseen circumstances
- Safety equipment required for large-scale environmental cleanup
- Emergency responses to large-scale disasters (clean-up and land remediation)