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NIEHS WETP  
**National Clearinghouse**  
for Worker Safety and Health Training

## For Immediate Release

### **NIEHS RELEASES ASSESSMENT REPORT ON WORKER SAFETY AND TRAINING NEEDS AT WTC SITE**

Washington, DC, October 23, 2001—The National Institute of Environmental Health Sciences (NIEHS) Worker Education and Training Program (WETP) released a preliminary assessment report yesterday on the potential safety and health hazards and training needs affecting on-site skilled support personnel and cleanup workers at the World Trade Center disaster site. The Report, which was discussed and released at the October 22 American Public Health Association annual meeting in Atlanta, contains information on significant risks that have been and continue to be faced by these on-site response and recovery workers.

“Absent a comprehensive WTC safety and health plan and given the lack of an organized safety and health presence on the site, we found it to be a very dangerous working environment where many workers lack the hazard-specific training required under current OSHA standards,” said Joseph T. “Chip” Hughes, Program Director of the WETP. A number of WETP grantees, including those training firefighters and construction workers, mobilized resource responses in an effort to begin training of on-site emergency search and rescue workers, technicians, and other specialists. It was estimated by local authorities that over 3,000 construction crafts/trades are working on the WTC Site daily.

“The WTC rescue and recovery efforts have occurred in an environment never before anticipated by current safety and health legislation and standards,” added John Moran, consultant to NIEHS and co-author of the report. “In light of today’s threats, we need to be prepared for any future bioterrorism or similar emergencies, by focusing primarily on the training needs of emergency first responders, skilled support personnel from the construction trades, and cleanup/demolition/removal workers.”

The WTC assessment report states that the loss of almost the entire emergency response command structure of the New York Fire Department, as well as most of the Department’s HAZMAT instructors, technicians, and specialists, resulted in a serious shortage of experienced HAZMAT personnel.

Conclusions of the assessment were made based upon observations made during a visit to the site from September 22-27, 2001, as well as analysis of the WTC Disaster Site Worker Injury and Illness Surveillance Update reports issued by the New York City Health Department. The full NIEHS WETP report can be downloaded on [www.wetp.org](http://www.wetp.org), entitled ‘NIEHS WETP Response to the World Trade Center (WTC) Disaster: Initial WETP Grantee and Preliminary Assessment of Training Needs.’

#### **About the NIEHS WETP**

The NIEHS WETP was created in 1987 by Congress as part of the Superfund Program to support the development of a network of non-profit organizations that are committed to protecting workers and their communities by creating and delivering high-quality, peer-reviewed safety and health curricula to target populations of hazardous waste workers and emergency responders. Through NIH extramural grants, the WETP awards cooperative agreements to support the development of curricula and training programs throughout the country to help employers meet OSHA requirements under 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response.

**National Institute of Environmental Health Sciences (NIEHS)  
Worker Education and Training Program (WETP)  
Response to the World Trade Center (WTC) Disaster:  
Initial WETP Grantee Response and Preliminary  
Assessment of Training Needs**



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## **EXECUTIVE SUMMARY:**

The attack on the World Trade Center on September 11, 2001 and the subsequent magnitude of the destruction and loss of life at the World Trade Center Complex (WTC) created an emergency response, rescue, and recovery effort of enormous proportions. New York City, State, and many Federal disaster response organizations, in addition to thousands of volunteers and other support organizations, quickly responded, including the NIEHS-Worker Education and Training Program (WETP). Several of the WETP grantees were among those support organizations responding for the purpose of providing quick-response training to workers, many from organizations with which the grantees are affiliated. In order to provide a perspective at the WETP Administrator level, a short-term technical assistance and coordination task order was executed with the authors, one of whom was dispatched to the WTC disaster site over the period from September 22 through September 27, 2001.

The purpose of the short-term task order was four fold: 1) assist in coordination of NIEHS-WETP grantee activities at the WTC Site, 2) assess the current safety and health status of response personnel working at the WTC Site, 3) evaluate the current Site safety and health plans or programs and related aspects such as exposure monitoring with respect to worker protections, and 4) perform a preliminary training needs assessment specific to the WTC Site activities.

With respect to the coordination task, both the International Association of Fire Fighters and the Operating Engineers National HAZMAT Program had launched an immediate and comprehensive response. As events unfolded, the authors and several other grantee organizations mobilized response resources, including coordination with the New York City Building and Construction Trades Council and the Construction Employers Association, Bechtel Corporation, the contractor responsible for developing the over-all WTC Disaster Site Safety and Health Plan, and other parties with respect to the training programs that could be promptly provided by the grantee organizations.

Assessment of the current safety and health status at the Site was based upon on-site observations and analysis of the WTC Disaster Site Worker Injury and Illness Surveillance Update Reports issued by the City Health Department. Evaluation of the current Site safety and health plans and programs and related aspects was not possible, as none were apparently applicable to the construction workforce. The training needs assessment task, therefore, was conducted solely on the basis of safety and health status observations and analysis of the injury and illness surveillance reports. Training recommendations, in broad terms, are provided in this report. Training needs assessments keyed to specific construction crafts or trades, an important dimension to aid in better targeting of training response and capacity assessments by the grantees, was not possible as the prime clean-up, demolition, and removal contractor's safety and health plans and related documents have not yet been released.

It became very apparent early in the WTC Site visit that the WTC Site was operating in a search and rescue mode being undertaken by NYC Fire and Police personnel and Federal personnel such as the FEMA Urban Search and Rescue Teams in accordance with the Federal Response Plan (FRP). In addition, massive utilization of contractor-provided skilled construction support personnel to aid in the rescue and recovery effort was evident. As this phase continued past the second week, there was no clear termination of the rescue and recovery effort owing, no doubt, to several factors such as the NYC Fire Department bearing responsibility for collapsed buildings and the fact that fires continued to burn in the Site debris pile. This situation created a very complex safety and health setting in which there was confusion as to which occupational safety and health standards were applicable, whether enforcement agencies indeed had enforcement jurisdiction, and at what point in time the WTC Disaster Site Safety and Health Plan would become effective and operative. Examples of the approaches to worker safety and health protection during this period were the Operating Engineers National HAZMAT Program on-site support operation providing several thousand respirators and cartridges to operators (and Police, FEMA Team members, among others), the OSHA Technical Support operation providing over 4,000 respirators and conducting air monitoring as a technical support activity likely under provisions of the Occupational Safety and Health Support Annex to the NRP, and the Carpenters Union Training Academy providing respirators and fit testing. Of importance, it must be noted that the determination that respiratory protection is required, and providing of such devices when required, is the responsibility of the worker's employer.

What has emerged in this massive disaster and the protracted and complex response is the fact that rescue, recovery, and other activities have occurred in a scenario never anticipated by the safety and health legislation or the subsequent standards/regulations. The injury and illness reports for the initial weeks of the search and rescue activity were at unacceptable levels. Moreover, the exposure data, as well as the potential for serious exposure to toxic materials (including asbestos) among the construction response workers, raises significant concerns. Accordingly, how to respond to such situations demands serious attention in the context of worker protection and training needs.

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## **INTRODUCTION:**

At 8:45 a.m. on September 11, 2001, hijacked American Airlines Flight 11 out of Boston was crashed into the north tower of the World Trade Center in New York City. At 9:03 a.m. a second hijacked airliner, United Airlines Flight 175, also out of Boston, was crashed into the south tower of the World Trade Center. At 10:05 a.m., the south tower collapsed. At 10:28 a.m., the north tower collapsed. At 4:10 p.m., Building 7 of the World Trade Center complex is reported on fire, and at 5:20 p.m. Building 7 collapses. At 7:45 p.m., the New York City Police Department reports that at least 78 of their officers are missing and the City reports that at least half of the first 400 firefighters who responded to the scene were killed.

While many thousands of those in the World Trade Center Complex were evacuated prior to the collapse of the two towers, thousands did not get out before the buildings failed. Further, the initial responding units of the New York City Fire Department (FDNY) included the emergency response command units and highly trained hazardous materials emergency response technicians, specialists, and instructors. In the collapse of the towers, essentially the whole emergency response command structure of the FDNY was lost as well as a majority of the Departments HAZMAT instructors, technicians, and specialists.

The New York City Mayor's Office of Emergency Management, Emergency Operations Center (EOC) was immediately activated. Fire Department and Police personnel were dispatched to the WTC site in a massive rescue operation. Concurrently, other emergency management actions were activated. State and Federal response, under provisions of the Federal Response Plan, were undertaken immediately as well by DHHS, FBI, FEMA, the dispatch of several FEMA Urban Search and Rescue Teams, the U.S. Army Corps of Engineers (in support of FEMA), EPA, OSHA, CDC, and others. (Additional information about the response activities of these organizations may be found at their web sites. See references.)

### Requests for Assistance from NIEHS-WETP

Shortly after September 11<sup>th</sup>, the NIEHS-WETP received an urgent request for supplemental funding assistance from the International Association of Fire Fighters (IAFF), an NIEHS-WETP training grant awardee, to aid in immediate efforts to begin training of hazardous materials emergency response instructional staff, technicians, and specialists in order to immediately begin re-building the City's emergency response capability, a capability that was severely depleted very early in the WTC disaster. Several other NIEHS-WETP awardees initiated disaster response support efforts as well, as many of the organizations for which they provide HAZWOPER and related training were involved in the disaster response effort.

NIEHS-WETP initiated a coordinated response assistance effort. One aspect of that effort was a task order under the National Clearinghouse NIEHS-WETP contract to provide



coordination support, including on-site assessment and coordination activities. This document is a report on the four specific sub-tasks assigned to the Clearinghouse under that task order.

This Report is a snapshot in time. It reflects the observations during a period from September 22<sup>nd</sup> through September 27<sup>th</sup> and subsequent information obtained through October 5<sup>th</sup>. The entire WTC Site is a constantly changing entity. Activities and efforts of government agencies, contractors and support organizations subsequent to October 5<sup>th</sup> are not, unless specifically mentioned, reflected in this Report.

### **THE INCIDENT RESPONSE EFFORT:**

The response to the WTC disaster has been enormous in both scope and complexity and has involved a wide range of resources from the City of New York, several State and Federal organizations, private contractors engaged by the City in various capacities, and many other support organizations such as the NIEHS-WETP grantees.

The magnitude of the destruction is difficult to perceive without visiting the site. The World Trade Center and related buildings are located on a 16-acre site bounded by Vesey, West, Church, and Liberty Streets. WTC Towers 1 and 2, Five WTC, Seven WTC, and the Marriott Hotel occupying this area collapsed or were destroyed. One Liberty Plaza, Four WTC, and Six WTC have partially collapsed. One, Two, and Three World Financial Center buildings adjacent to the WTC site suffered major damage, as did six other major structures adjacent to the WTC Site. Subway and PATH train tunnels, the Concourse level, the Mall, six levels of parking decks, and storage decks below and adjacent to the WTC site have partially or completely collapsed. The building materials and steel rubble at the WTC site alone is estimated to be in excess of 1.2 million tons.

Under the City of New York Emergency Response Plan, the Fire Department is responsible for managing responses to building collapse incidents. This Report is based on specific observations and information obtained through October 5, 2001. As of October 5, 2001, the activity at the site remained in an initial search and rescue management phase under the management of the Mayor's EOC Office and the Fire Department. The matter of control is very fluid and may well have changed substantially since October 5<sup>th</sup>. Each day brings another change in the management process. New contracts are being let for demolition and cleanup services. This is to be expected in a project of this magnitude.

The following response activities are of relevance to this Report:

1. Number of personnel working at the WTC Disaster Site:

The following estimated number of personnel are working daily at the WTC Disaster Site, by organization. Operations are being conducted on a 24-hours/day basis.

Fire Department	1200	10 and 12-hour tours.
Police Department	2000	12-hour tours.
FEMA Urban S. & R.	496	12-hour tours.
Construction	1350	8 and 12-hour tours.
Sanitation Department	85	-----
TOTAL:	5135	

These are estimates that may not include other organizations, such as Con-Edison crews. With the exception of the FEMA Search and Rescue Teams, Federal personnel from EPA, OSHA, USACE, and others are not included.

## 2. Prime construction contractors:

Four prime construction contracts have been awarded to support the rescue operations. These have been to: Tully, Bovis, Turner, and AMEC. Each has been assigned a “zone” of operation and responsibility within the WTC Disaster site, each representing approximately one-quarter of the area of the site. (Reference 1) AMEC and Bovis are operating three 8-hour shifts/day, while Tully and Turner are operating two 12-hour shifts/day. AMEC is reported to be employing 150 workers per shift, 450/day; Bovis 100 per shift, 300/day; Tully 150 per shift, 300/day; and Turner 150 per shift, 300/day. Total daily construction hours worked is 158,400 based upon these estimates. (Reference 9)

## 3. Environmental, Safety and Health Oversight Contract:

Bechtel has been awarded a 90-day contract to develop the WTC Disaster Project Environmental, Safety and Health Plan. The Bechtel organizational structure responding to this contract is shown in Reference 2. Bechtel has developed at least two Draft World Trade Center Emergency Project ES&H Plans. The latest available to the authors as of October 5, 2001 is Revision A, dated 30 September 2001, which was received on October 3, 2001 after significant difficulties arose in obtaining copies by non-Agency organizations. (See below for more discussion on this issue.) That Draft indicates that the Site Logistic Plan, Site Demolition Plan, Site Asbestos Removal Plan, Spill Prevention and Response Plan, and Storm Water Pollution Prevention Plan were “under development.”

It is unclear, at this writing, as to when the final WTC Disaster Site ES&H Plan will be issued and implemented.

## 4. Air Monitoring:

EPA, OSHA, and the Operating Engineers National HAZMAT Program (OENHP) have been conducting bulk, area, and personal monitoring data. Other organizations are reported to be doing so as well, although their data is not available to us at this point. Bruce Lippy, with the OENHP, provided a summary of the EPA, OSHA, and OENHP data in a presentation to Dr. Kenneth Olden, Director of NIEHS, on October 4, 2001. His Power Point presentation “Air Monitoring Overview” is provided as Reference 3. The



OSHA Web Site ([www.osha.gov](http://www.osha.gov)) provides monitoring data obtained at the WTC Site. The October 3, 2001 report provided the results of 67 personal air-monitoring samples and concluded that “None of these samples exceeded OSHA’s permissible exposure limit of 0.1 f/cc (of asbestos) as an 8-hour time-weighted average.” However, it is important to note that some 18% of the samples evidenced asbestos fiber counts in excess of 0.1 f/cc, although full shift duration samples were not taken.

#### 5. WTC Site Hazardous Materials Identification:

Table 2 in Revision A of the Site ES&H Plan dated 30 September 2001 lists the following materials as being present at the WTC Site as well as materials present in the several WTC structures. No quantities are provided. Reports indicate that asbestos was present in pipe insulation in both WTC towers, up to the 40<sup>th</sup> floor in one tower and the 20<sup>th</sup> floor in the other tower.

Chemicals existing at WTC Site: Diesel fuel, Asbestos, PCB, Crystalline Silica, Carbon Monoxide, Formaldehyde, PaH’s, Zinc Oxide, Mercury Compounds, Arsenic, Nickel, Lead, Cadmium Fume, Chromates, Benzene, HCL, HF, Hydrogen Sulfide, Gasoline, Freon (R-22), and spray paints and thinners.

#### **THE NIEHS-WETP WTC ASSESSMENT TASK ASSIGNMENT:**

The National Clearinghouse for Worker Safety and Health Training, pursuant to Contract # 273-FH-013264, was tasked by the NIEHS-WETP to undertake specific activities associated with the WTC disaster. The specific sub-tasks were:

1. Assist with coordination of NIEHS-initiated WTC Site activities by WETP grantee organizations with the existing Incident Command structure and federal, state and local emergency response agencies and other organizations as needs become apparent.
2. Assess the current safety and health status of site response and rescue workers with respect to compliance with OSHA 29 CFR 1910.120 (HAZWOPER) requirements and other applicable state and federal safety and health requirements for worker protection for purposes of identifying potential training needs.
3. Evaluate the current WTC Site safety plans, site environmental and worker monitoring data, inventories of hazardous materials and substances present in the collapsed structures, and levels of personal protection requirements for rescue and recovery workers, with respect to current and near-term operations at the Site for purposes of estimating training needs.
4. Perform a WTC Site training needs assessment for both immediate and short-term occupational safety and health and appropriate craft skills requirements for the recovery and potential demolition workforce in line with current requirements for EPA, OSHA and Army Corps of Engineers hazardous waste site protocols based upon available information.

John Moran was dispatched to the WTC as the safety and health liaison to provide an on-site perspective in responding to the tasking assignment. He was on-site from September 22 through September 27, 2001. Donald Elisburg served as the off-site coordination point, which proved to be of substantial value due to communication difficulties in the WTC area.

Responding to the specific sub-tasking elements reviewed above presented significant challenges and difficulties.

While the New York City Fire Department was “in-charge” of the WTC Disaster Site, the Incident Commander was, as a practical matter, the Mayor through the New York City Mayor’s Emergency Management structure. The enormous magnitude of the disaster and the impact on the City, the huge loss of life including over 400 fire fighters and police, the loss of essentially the whole emergency response command structure in the Fire Department, and the massive federal response to the disaster/crime scene created what is likely the most complex emergency response and management challenge ever faced in the Nation. As a consequence, close communication and coordination was occurring at only the highest levels. This began to expand and extend as disaster response management took hold, although effective communications and participation of affected parties with respect to worker safety and health matters remains a serious challenge, especially with regard to workers and their representatives.

Assessment of safety and health status of site response workers with respect to compliance with 29 CFR 1910.120 was not, in terms as stated in the sub-task element, possible at the time of the site visit, because the disaster site was still in the rescue phase of the emergency response. With respect to 1910.120, the response and rescue phase is governed by 29 CFR 1910.120(q) until such time as the Incident Commander terminates the rescue phase and turns the site over to clean-up operations.

At the time of the site visit, and to at least October 5, 2001, the WTC Disaster Site would appear to be under the emergency response provisions of 1910.120 and the four prime contractor entities would be considered as providing “skilled support personnel” to aid in the response and rescue operations. Skilled support personnel are not required under the 1910.120(q) provisions to be specifically trained as emergency responders in accordance with the requirements of 120(q) or the “clean-up” requirements of that standard under 1910.120(b)-(o). They must, however, be provided sufficient instruction on site-specific hazards, the wearing of appropriate personal protective equipment, and other appropriate safety and health considerations. (See OSHA Interpretation Shermann 920327.)

The writers were advised that when the WTC Disaster Site transfers from emergency response and rescue to clean-up and removal that compliance with the HAZWOPER standard at 29 CFR 1910.120 will not be required.

Evaluation of the then current WTC Site safety plans and monitoring data with respect to hazardous waste site response and remediation requirements was simply not possible. As of October 5, 2001, no WTC disaster site safety and health plan apparently existed.

Monitoring is being conducted by some organizations, largely federal (EPA and OSHA). EPA monitoring efforts began early with specific regard to concerns about public exposures to asbestos and other potential contaminants in the dust and smoke being released from the site. OSHA began air monitoring somewhat later with emphasis on personal exposure monitoring, as did the OENHP Industrial Hygiene staff. (See summary in Reference 3.) A preliminary inventory of hazardous materials and substances in the WTC structures was presented in the WTC Disaster ES&H Plan draft of 30 September 2001. Many such materials are present, including asbestos, lead, silica, arsenic, and freon.

Evaluation of the levels of personal protection in-use at the Site at the time of our visits with respect to hazardous waste site response and remediation was a simple task within the context of the tasking element in that PPE was simply not utilized by most of the workforce.

Only a very preliminary training needs assessment based upon evaluation of Site injury and illness incidents for the period 9/14 through 9/25 and Site observations could be conducted because the site has not transitioned to the clean-up and removal phase nor has either the Site Safety and Health Plan or prime contractors' Safety and Health Plans been issued or implemented. Absent these Plans, which should contain specific training requirements and regulatory standards under which operations will be governed, it is simply not possible to provide a rigorous training needs assessment.

The following sections address the four sub-tasking elements:

#### I. Coordination:

Upon arrival and tour of the WTC Disaster Site it became apparent that coordination aspects needed to be undertaken with a different approach than initially conceived. The Site was still in a serious rescue phase; the support contractors evidenced little if any attention to safety and health, let alone training, and communications and coordination among the various organizations with respect to safety and health particularly was isolated and difficult at best.

#### NIEHS-WETP Awardee Activity

The IAFF immediately responded to the disaster that had stricken their members in NYC. IAFF dispatched over 100 seasoned IAFF members to work with the NYC locals, they coordinated their response plan with FEMA and the FDNY, arranged to provide critical stress management services, established an IAFF headquarters office in NYC to assist the local unions with administrative and family services issues, and brought in administrative staff from IAFF headquarters in Washington. The WETP-funded program at IAFF immediately undertook efforts to begin training FDNY personnel to replace the HAZMAT instructional staff, technicians, and specialists that were lost in the collapse.

A major and comprehensive effort was undertaken by the Operating Engineers National HAZMAT Program that involved moving their mobile training facility to the Site from

West Virginia, with a stop at MSA in Pittsburgh to procure respirators and cartridges. Industrial Hygiene staff were deployed to the Site. The OENHP began air monitoring; developed informal guidance booklets on the site hazards; provided respirators, cartridges, hard hats, tyvek coveralls, and other PPE; and worked with the individual IUOE member heavy equipment operators to get them into respirators. They also worked with OSHA technical support personnel to facilitate personal air monitoring of their operators. Despite this level of effort and commitment, they were able to obtain only fragmented information about the safety and health program activities on the site at the time of John Moran's arrival on the site on September 22, 2001. (Reference 6)

Other WETP grantee organizations including L-AGC/IBT, CPWR, and UMDNJ (UBC) were also beginning to mobilize their responses to the disaster. See Reference 7 for the WETP WTC Updates issued by the WETP or the Clearinghouse web site at [www.wetp.org](http://www.wetp.org).

A summary of the coordination activities related to the worker safety and health training issues undertaken, or observed, by the authors includes:

1. Site Safety and Health meetings began to be conducted at 8:00 a.m. every day starting on or about September 20, 2001. These meetings were apparently convened by Bechtel. WETP and labor organizations were not aware of these meetings. An EPA official brought it to the attention of the WETP Director and the Site liaison. WETP and labor representative organizations on site were informed. Conversations with the OSHA Regional Director indicated that these meetings, which OSHA personnel attended, had been largely focused on public health matters with little attention to worker safety and health. She expressed the desire to have labor and WETP grantee safety and health personnel involved and participating so that worker safety and health issues might be more fully considered. Labor representatives and WETP grantees on-site began to attend these meetings on September 25, 2001.
2. Pete Stafford, Director of Safety and Health for the BCTD and Director of the Center to Protect Workers Rights (CPWR), a WETP grantee, arranged for a joint meeting of the NYC Building Trades Council and the Construction Employers Association on matters associated with support that the CPWR could offer specific to the WTC Disaster. Arrangements were made for Pete Stafford to provide summary information on the courses available through the WETP grantees to support the training program needs of the contractors during the WTC clean-up effort. (Reference 4)
3. The summary information (Reference 4) depicting the courses available and WETP grantees available to deliver them was also provided to Bechtel and OSHA in order to facilitate wide dissemination of this information.
4. Peg Seminario, Director of the AFL-CIO Department of Occupational Safety and Health, organized an AFL-CIO WTC Cleanup Work Group, which held a meeting with OSHA and NIOSH to discuss the safety and health situation at the WTC Site. On September 20, 2001 that Department issued comprehensive information and fact sheets to Unions involved in the WTC Rescue and

Cleanup efforts. Bill Kojola, in the AFL-CIO S&H Department, was designated as the WTC Coordination point for the AFL-CIO and Pete Stafford for the BCTD. (Reference 8 contains this information package.)

Communications with Messrs Kojola and Stafford were established and continued.

5. Additional communications and coordination links were established with Bechtel, EPA, OSHA, FEMA, several other WETP grantee organizations, and the Department of Occupational Medicine at Mt. Sinai Hospital in New York City, the New York Committee on Occupational Safety & Health (NY COSH), Hunter College and Johns Hopkins University. The Director of NIEHS, Dr. Kenneth Olden, was accompanied by the WETP Director to NYC on October 4<sup>th</sup> and convened a meeting of the WETP Awardees conducting Site related activities in order to review the various activities and begin planning for the next phase of the WTC cleanup operation.
6. A conference call among members of the EPA-Labor Superfund Task Force was held on October 3, 2001. Primary topic was discussion of safety and health issues pertained to the WTC and Pentagon Disaster Sites. After an hour and half of information exchange and discussion, there was agreement that many lessons could be learned from these two tragic incidents, which could aid future disaster response activities with specific reference to worker safety and health. Reports, such as this one, and others could serve as the basis to begin to focus on the lessons learned dimensions. The next meeting of the Task Force is in November. There is a desire for definitive recommendations at that point with respect to advancing the lessons learned approach. These recommendations will be presented and discussed with the new AA for OSWER at EPA during the upcoming annual meeting of the Task Force with the OSWER Assistant Administrator.

With respect to conveying information about the response assistance capabilities of the WETP and the WETP grantees, it became evident that the prime contact points must be the contractors engaged in the subsequent cleanup effort. The information provided by the CPWR at the meeting of the NYC Building Trades Council and the Employers Associated was critical to that dissemination effort. Getting the information to other key participants has been of value as well. Of course, the grantee organizations supporting the NYC trades have their traditional labor-management channels through which to convey the information.

## II. Safety and Health Status:

The following worker safety and health protection practices were observed by John Moran during his initial tour of the WTC Disaster Site on the afternoon of September 22, 2001:

## 1. Site overview:

The collapsed towers and immediately adjacent structures are piles of debris and twisted steel beams 2-4 stories high in places and within pits in others. The debris pile continues to burn in several places. Perimeter buildings are burned, severely damaged, partially collapsed, and/or have most or all of the windows blown out on the sides facing the WTC Site. Steel beams two inches thick, three feet deep, and a foot wide are torn as if a piece of paper. Street-level stores a block or more from the WTC Site have the windows blown out and the interiors are covered in thick layers of a grayish dust. Dust is everywhere, most of it wetted on walking and working surfaces, reducing re-entrainment significantly. There are large numbers of heavy construction equipment, trucks, fire department equipment, police vehicles, military vehicles, and ambulances on and near the site. There are large numbers of workers at the site and in the supporting areas including construction workers, fire fighters, police, federal personnel, military, FBI, and others. Tents line the perimeter streets providing drinks, food, first aid, counseling, washing facilities, and personal protective equipment such as goggles, ear plugs, and respirators. These are primarily volunteer organizations such as the Salvation Army.

Work to this point appears to have been devoted primarily to search and rescue efforts for survivors and to clearing access routes on the streets bordering the WTC complex, all of which were initially covered with debris from the initial structure collapses. Access to the site is controlled and requires appropriate badging. Several check points manned by police and military personnel must be passed in order to gain entry. Truck routes to and from the site have been established for purposes of moving debris from the site. There are, according to a Bechtel individual, some 27 entry points to the “hot zone” (the WTC Complex collapse site).

## 2. Personal Protection Observations:

The following observations are generally focused on the construction activities, and construction workers, on the site and not on the Fire Department rescue teams or Federal disaster assistance personnel.

As a general statement, no uniform level of personal protective equipment usage is evident. Most workers, but not all, are wearing hard hats. It is estimated that perhaps 50% are wearing eye protection, whether safety eyewear was not determinable. Most workers appear to be wearing work boots, whether safety boots was not determinable. Clothing varies from long work pants and shirts to short pants and tee shirts. Respiratory protection is rare. The exception is the heavy equipment operators (IUOE), nearly all of whom are wearing half mask air purifying respirators with HEPA/OVAG combination cartridges. A small percentage of truck drivers are wearing respiratory protection of the type worn by the Operators. Perhaps 5-10% of the workers are wearing disposable dust masks. Workers were observed at or near the top of the debris pile in the smoke plume emanating from the pile in tee shirts without hard hats, eye wear, or respirators. Torch cutters were not wearing respiratory protection nor protective goggles or face shields.



Police and military personnel on the site were not equipped with personal protective equipment.

### **3. Safety and Health Observations:**

The WTC Disaster Site is a very dangerous work site. Heavy equipment and trucks are always on the move and routes are not always obvious, the swing arc perimeters of cranes are not marked or barricaded, spotters are generally not present when large equipment is being moved or when heavy trucks are backing up, and there are numerous construction vehicles moving equipment and supplies all over the site. The debris pile is unstable and treacherous to work upon. The area of immediate destruction is also surrounded by numerous damaged building structures, some of which will likely have to be demolished.

Vehicles leaving the site with debris, either dumps or lowboys with large sections of steel beams, are not deconned and the dumps do not have covers over the loads. As a consequence, potentially hazardous dust and debris is tracked off site or is blown from the loads during transit. Workers do not decon upon leaving the site. There are a couple of hand/face and boot wash stations set up on the perimeter by volunteer organizations, but these do not appear to be utilized by most of the workers.

Compressed gas cylinders, cans of gasoline, and similar such potentially hazardous materials are utilized on the site. Many are not labeled, most are not stored properly (gasoline cans on the edge of vehicle transit routes, for example), and compressed gas cylinders are not properly stored nor moved. (Cylinders were observed being rolled down slopes without cylinder caps, for example.)

Noise levels, with the exception of areas in immediate proximity to heavy equipment operations, does not appear to present a hazard on the site.

This site also has permanent odors from the fires and collapse, including very obvious odors from decomposing bodies still entombed in the rubble. We have been advised by those undertaking air sampling that the odor while very bad is not harmful. Even though not toxic, the constant smell of death brings with it a degree of psychological stress.

### **4. Safety and Health Program/Personnel:**

The presence of contractor safety and health personnel was not obvious. Safety and health personnel from a few support organizations, such as the OENHP, were visible however. A number of OSHA compliance officers and IH personnel were present on the site in their capacity to provide technical assistance and support. There was no evidence or even suggestion that any safety and health program was operative at the site, indeed the very opposite seemed to be the case. The lack of an operating safety and health program was confirmed by various support personnel, workers and various government officials.

## **5. The Site Workers:**

Discussions with many workers from several crafts indicated that most had been on-site since the disaster response effort began. They have been working seven days a week since that time, most 12 hours on-12 hours off shifts. They were tired, very fatigued, and simply worn out.

## **6. The Public:**

Tours are frequently conducted at the site. Those observed were utilizing no protective measures, walking through the muddy debris and dust in business attire including dress shoes, for example. Many members of the public line the outer control perimeters of the area. They are clearly supportive of the response workers' efforts and offer bottled water and cold drinks to those leaving the site that may want such. These groups have mostly dispersed in recent days.

## **7. Atmosphere:**

The clear impression is that this is a major disaster site engaged in a massive rescue operation. This is a heroic endeavor by fire, police, federal disaster teams, and support workers. Considering the catastrophic circumstances of the initial event, as well as the enormous problems of the search and rescue phase, the various entities engaged in these activities, including OSHA, EPA and the construction crews, clearly performed with extraordinary professional competence. There were no 'textbook' solutions. The realities are that in such a setting there is little attention to or concern devoted to worker safety and health issues among the support operations. Specific entities such as the IUOE through the OENHP, conducted air monitoring and literally talked with each individual heavy equipment operator to convince the operators to wear respiratory protection based upon the air monitoring results, and subsequently provided the necessary equipment and replacement cartridges. The OENHP also prepared pocket-sized guidance pamphlets specific to the WTC Disaster Site addressing general site hazards and respiratory protection. (Reference 6) The United Brotherhood of Carpenters (UBC), through their training academy located near the site, conducted fit testing and provided respirators to their members. The Laborers' International Union of North America (LIUNA) responded with respirators and protective clothing through its various locals. Such efforts as these are, in any normal construction project, conducted by and the equipment provided by the workers' employers. That normality was not the case in this situation.

## **8. Changes observed during 22-26 September period:**

Observations at the WTC Disaster Site over this period evidenced an increasing utilization of personal protective equipment by construction workers, notably respiratory protection. Vehicles leaving the site began to be hosed-down by fire fighters. This decontamination effort slowly transitioned to power washing of the whole vehicle, although the personnel conducting this activity were not equipped with protective gear.

OSHA technical support personnel, who had been conducting personal air monitoring by having individual OSHA staff walk increasingly closing circuits around the WTC Site, transitioned to placement of personal air monitors on individual workers facilitated by labor representatives of the various construction crafts, commencing with the heavy equipment operators.

At the September 25, 2001 site safety and health meeting at 8:00 a.m., Bechtel announced that efforts were being undertaken to designate the WTC Disaster site rubble pile as a restricted zone (hot zone) with a greatly decreased number of personnel and vehicle entry/exit points, requirements for new badging of personnel authorized entry, and minimum levels of personal gear that all entrants must have for entry. That minimum level of gear included hard hats, safety glasses with side shields/face shields/or goggles, half mask APR with combo P100/OVGA cartridges, leather gloves with latex inner gloves, coveralls or long sleeved work shirts, and steel-toed boots. An outer perimeter support zone was also established. Work to implement these changes was to begin on September 25, 2001, although these requirements had not yet been implemented as of the date of this Report.

### III. WTC Site Safety and Health Program/Plan:

As noted previously, no WTC disaster project safety and health plan apparently exists as of October 5, 2001. Draft ES&H Plans have been developed and are in review and development. These require that the individual prime contractors develop ES&H Plans that incorporate the requirements of the Site Program. Contractor ES&H Plans are being developed concurrently with the Site Plan. It remains unclear at this writing as to when the Site ES&H Plan will become effective.

Based upon review of Draft Revision A of the Site ES&H Plan, there are, however, many serious potential deficiencies. The primary deficiencies relate to a complete lack of overall S&H site coordination on this multi-employer site, lack of a clear S&H organizational structure to facilitate attention to concerns that workers or their representatives might have, and a complete lack of participation by workers or their representatives. There are many other issues with the Draft that require attention as well.

The development of the Site ES&H Plan has been a frustrating process for labor representatives. The “next chapter of the safety and health program” was launched at the 8 a.m. site safety and health meeting on September 25, 2001 by announcing the effort lead by Bechtel to develop the Site Program. Bechtel announced that several agencies were participating in the process and that other volunteers wishing to participate in the process would be welcome. Labor representatives hopes that they would now begin to have an opportunity to participate in this critical activity were quickly dashed when the New York City Department of Engineering and Construction subsequently refused to allow these representatives to have copies of the Draft Plan, stating that it was restricted to Agencies participating in the process. This refusal to provide copies of the Draft Plan was not a single incident but several such incidents among different organizations.

Subsequently, arrangements were made with the CPWR to act as liaison with Bechtel in providing comments to the Draft Plan. The CPWR has provided its concerns regarding the Draft Plans to Bechtel. (Reference 11) It is not clear as of this writing how the various contractors are handling worker involvement in developing their respective safety and health plans.

#### IV. Preliminary Training Needs Assessment:

In order to develop a training needs assessment specific to the support that the NIEHS-WETP grantees could provide for the clean-up phase of the WTC Disaster Site operation, several inputs are required. These include, at a minimum:

1. Training required by the Site S&H Plan and by the contractor S&H Plan.
2. Whether the WTC Disaster Site will require compliance with the OSHA Hazardous Waste Operations and Emergency response standard at 29 CFR 1910.120?
3. The hazards present on the site for which specific OSHA standards apply and which require specific training, such as asbestos and lead.
4. The number of workers, by craft or trade, that will be employed and the crafts or trades that will require hazard-specific training.
5. The time frame within which training can be provided.
6. The capability of the NIEHS-WETP grantees to provide the training identified.
7. The capacity of the NIEHS-WETP grantees to provide the training identified.

At this writing, the situation specific to each of the above requirements is as follows:

1. The Draft Revision B to the WTC Disaster Site ES&H Plan only requires that all site workers have site orientation training. All other specific training is to be identified by and included in the individual contractor S&H Plans. These plans were not available at this writing and are not likely to be available until the final Site ES&H Plan is issued, as integration of the individual contractor S&H Plans with the Site Plan is required. Contractors will be responsible for determining whether asbestos training, for example, is required.
2. We have been informed that the Site will not be operated under provisions of 29 CFR 1910.120. Therefore, specific HAZWOPER training does not appear to be a requirement at this time.

3. Hazard-specific training requirements will be determined by each contractor. Hazards known to be present at the Site suggest that hazard-specific training specific to asbestos and lead will be required. In addition, HAZCOM training should be required for all workers, although the Draft Revision A of the Site ES&H Plan qualifies this requirement.
5. The number of workers by craft or trade requiring hazard-specific training or the time frame within such training needs to be provided cannot be estimated until such time as the contractor Project Plans and S&H Plans are issued.
6. The capability of the grantees to provide the identified training cannot be determined until such time as the training requirements become known. The capability aspect specifically refers to whether individual grantees have the required training programs and instructional staff already on-line and available for delivery in the needed time frame.
7. The capacity of the grantees to provide additional training to workers at the WTC Disaster Site is an assessment of the capacity of the grantee to provide additional training beyond their current training plan schedule and, in some cases, to deliver such at sites remote from their fixed training centers. An initial assessment of core capacity in the NY/NJ area based upon HAZWOPER and related training, delivered by grantee organizations during the September 1, 2000-August 31, 2001 period, has been developed by WETP Staff. It is included as Reference 5.

Based upon a request from the NIEHS-WETP Director, WETP grantee organizations have been developing preliminary estimates of the training needs envisioned as needed by the organizations that they support which are engaged in or are anticipated to be engaged in the WTC clean-up effort. These estimates will provide a solid basis upon which to advance the WTC-specific training needs assessment once the matters identified above have been addressed and specified.

### **Analysis of Injury and Illness Incidents**

In order to attempt to identify potential training needs, we performed an analysis of the injury and illness incidents reported by the NYC Department of Health for the period 9/14 through 9/25, 2001. In that analysis, we sought to estimate training needs based upon the adverse outcomes represented by the injury and illness summary report. We combined our Site hazard and operations observations with the results of the injury and illness outcome analysis to develop a preliminary list of training needs by training subject.

The injury and illness incidence report analysis was approached in the following manner:

Sources: References 9 and 10.

Notes:

1. Activity at time of injury, while in the data collected, is not reported in the Updates.
2. Eye and lung injuries have several sub-categories, which are not reported in the Updates. Only total eye and lung injuries are reported.
3. Updates do not permit determination of OSHA “reportable” injuries or illnesses.
4. Analysis considered only the construction workers.
5. Total construction hours worker per day are derived from Reference 9 and are assumed to be representative of the Surveillance Update period covered: 9/14 through 9/25. (158,400 hours/day)
6. Incidence rate is calculated on the basis of the BLS definition of occupational injury/illness incidence rate in terms of injuries/illness per 100 workers per year. The BLS reported total injury/illness incident rate for construction in the US for 1999 was 8.6. By way of a specific large construction project reference, at the point where the Boston Harbor Project had completed 5.8 million contractor hours, the lost time incidence rate was 6.9 and the medical only incidence rate was 11.0.
7. The Updates contain two categories of adverse outcomes, “unknown” and “other.” While the incidences within “other” are listed by number of injuries/illness with more than 5 occurrences, this is presented for the whole workforce and “unknown” is simply the number of occurrences for each worker category for which the nature of the occurrence is not known. “Unknown” represents some 14% of the construction worker group.

Injury and illness occurrences in construction at the WTC Site from 9/14-9/25

<b>Injury or Illness</b>	<b>Number reported</b>	<b>% of total injuries/illnesses</b>
Abrasion	19	2
Blister	116	12
Burn	35	4
Contusion	7	1
Crush	3	-
Dehydration	5	1
Eye Injury, combined	101	10
Fracture	7	1
Headache	83	8
Laceration	67	7
Lung injury, combined	40	4
Nausea/vomit/diarrhea	23	2
Skin irritation/rash	46	5
Sprain/strain	77	8
<b>TOTAL*</b>	<b>995</b>	<b>100</b>

\*Not all categories are included in the table.



Incidence rates (per BLS definition):	Eye injuries, combined	128
	Lung injuries, combined	50
	Strain/Sprain	97
	Combination A.	424
	Combination B.	192
	TOTAL Incidence rate	1,256

Combination A (Trauma): Abrasion, Blister, Burn, Contusion, Crush, Dehydration, Fracture, Laceration, Sprain/Strain.

Combination B: Headache, Nausea/vomit/diarrhea, Skin irritation/Rash.

Training implications:

1. Eye injury incidence rate suggest that **PPE training** (and required use of protective eyewear including side-shields) is critical and it is likely that Cutting/Burning training is needed as well, based upon Site observations.
2. Lung injury incidence rate suggests that **Respirator training** and **Confined Spaces** training are critical. Respirator medical certifications are required as well, of course. Confined Spaces issue arose in discussions with FEMA US&R Team Physician and is included in the Lung Injury, combined category as “Asthma exacerbation” and, perhaps “SOB/Wheezing.” Exposures in Confined Spaces could also contribute to several other injury/illness categories such as Headache, Nausea/vomit, and Skin irritation/Rash.
3. Strain/Sprain incidence rate suggest that attention to ergonomics could be beneficial. **Ergonomic** training is available.
4. Combination A incidence rates suggest that **General Construction Safety/OSHA-10 and PPE training** is merited.
5. Combination B incidence rates suggest that **HAZCOM training** is essential.
6. Hazard specific training may also be required associated with the hazardous materials and substances known to be in the debris pile based upon WTC Complex inventories and work activities that may result in exposures in excess of the PELs. (See The Incident Response Effort, 5.)

## CONCLUSIONS:

The following are conclusions drawn by the authors specific to the tasking assignment from the WETP and to occupational safety and health matters observed at the WTC Disaster Site.

1. WETP supported grantees provided significant and important immediate responses in support of the WTC Disaster response effort.

- A. The immediate response effort undertaken by the IAFF was massive and dedicated. With respect to the WETP supported grant program at IAFF, that organization promptly undertook efforts to provide training support to rebuild the FDNY HAZMAT instructional staff, technicians, and specialists; most of the existing such resources within the FDNY having been lost during the collapse of the WTC Towers. That effort will take time, of course, but the dedicated efforts of the IAFF will make a significant contribution to aiding the FDNY in rebuilding their emergency response capacity.
  - B. The significant response support actions undertaken by the Operating Engineers National HAZMAT Program proved to be of great value to IUOE members working the WTC Site, other organizations such as the FEMA Response Teams with regard to provision of much needed protective equipment, and to workers on the site in general by actions undertaken in support of OSHA efforts to obtain personal air monitoring data and through the conduct and sharing of data obtained in extensive media and air sampling conducted by the OENHP Industrial Hygiene professionals on site. This team made a major contribution and should be commended for having the foresight to launch this support effort.
  - C. The Carpenters Union Training Academy, located near the WTC, undertook specific efforts to conduct respirator fit testing and provide respiratory protection to their members currently working at the Site.
  - D. The CPWR organized a key meeting and briefing of the NYC Building Trades Council and the Construction Employers Association during which the training support resources of the WETP grantees, which can be brought to bear on the WTC cleanup operation, was presented and discussed.
  - E. Other grantee organizations and those affiliated with them provided response support as well, including the Laborers-AGC Education and Training Fund (L-AGC), which sent its mobile training unit to New York City and provided respirators to Site workers, and the University of Medicine and Dentistry of New Jersey (UMDNJ).
2. As of October 5, 2001 activities at WTC Site remain in rescue phase. Despite the fact that four major construction contracts have been awarded, the construction activities remain in what could be described as the “skilled support personal” category as defined at 29 CFR 1910.120(q)(4). A significant number of these workers started as heroic volunteers and now have continued with contractors working at the site since the tragic collapse of the WTC structures. They are tired, weary, and extremely fatigued and they are operating in an environment essentially devoid of any organized safety and health protection programs. Were it

not for the initiatives of a few organizations, such as the OENHP, UBC, OSHA's compliance assistance staff and others, these workers would likely still be largely without important protective gear. There is a critical need for a definitive closure of the rescue phase and transfer to cleanup, demolition, and removal phase.

The WTC Disaster Site cleanup will not, we are informed, be conducted under provisions of the OSHA Hazardous Waste Operations and Emergency Response standard at 29 CFR 1910.120. This decision, in our view, may be inappropriate in that the Site is in clear need of that worker protection pro-active standard based upon the nature of the activities to be conducted, the inventory of hazardous materials known to be present on the site, the fact that the nature of the collapse and resulting debris pile makes it nearly impossible to determine when increased exposures to these hazardous materials (particularly asbestos) will occur as clean-up and removal activities progress, and the presence of many of these materials in the bulk/area/personal monitoring data already obtained. 29 CFR 1910.120 provides a comprehensive basis for training of workers, medical surveillance, exposure monitoring, and worker protection levels that are downgraded based upon work site monitoring data rather than the typical health standards compliance approach in construction which upgrades worker protection after the fact of increased exposures. It seems likely that the authorities have some confusion over the differences between a site protected under 1910.120 and an EPA declared Superfund site. It is not necessary to declare this site a Superfund site in order for 1910.120 to apply. For simple example, all leaking underground fuel storage tank removals required by EPA regulations have been and are conducted in accordance with 1910.120.

3. We are not able, nor are others such as the WETP grantees, to provide a definitive estimate of the training needs required to support the cleanup phase of the WTC Disaster Site as the Draft Site ES&H Plan which we have reviewed establishes no definitive training requirement, leaving such a determination to the four prime contractors. The ES&H Plans from the prime contractors have not yet been made available for review. However, based upon an analysis of injury and illness adverse outcomes reported and Site observations, we suggest that the following training would be appropriate, and perhaps required by the subsequent Prime Contractor S&H Plans:

- Asbestos
- Lead
- Confined Spaces
- General Construction Safety/OSHA-10
- Personal Protective Equipment
- Respiratory Protection (and remaining requirements of 1910.134)
- Fall Protection
- HAZCOM

4. OSHA has served as a significant technical support resource through participating in the development of the WTC Disaster Site ES&H Plan, in conducting air monitoring, and participating in walk-around safety and health observations of the Site with Bechtel personnel. OSHA has not, up to October 5, 2001, been operating in an enforcement mode, although OSHA has made it known that they will begin enforcement activities in the near future. The technical support role undertaken by OSHA is likely governed by the Occupational Safety and Health Support Annex to the Federal Response Plan.
5. There is a need to carefully review this emergency response activity from a worker safety and health perspective and glean lessons learned from the tragic incident that may be of value in future similar incidents. While the sheer magnitude of this particular disaster will likely never be experienced again in this country, that very aspect has stretched all involved, including response plans and efforts, to extreme limits. Valuable lessons can be learned and should be shared to the appropriate organizations.
6. There are many other organizations that played a role in helping aid and advance worker safety and health at the Site during these first few weeks since the incident. We apologize for not having mentioned those that we have some awareness of and those about which we not aware at this point in time. However, the urgency associated with completing this initial effort dictates that this Report be timely and not exhaustively detailed.

## **DISCUSSION:**

The enormity of and the consequences of the terrorist attacks on the WTC Complex can never be overstated. The enormous impact on the City of New York and its response resources, the huge loss of life of both civilians and public servants, and the heroic dedicated massive rescue and recovery efforts have been unparalleled.

The complexity of this rescue, recovery, demolition and construction project cannot be overstated. Two recent NY Times Articles (References 12 and 13, October 9, 2001) are representative of the difficulties the workers are facing on this project. The safety and health issues are only one part of the enormous problems confronting everyone on the project. The Federal Response Plan was activated at the WTC Site shortly after the collapse. That Plan ([www.fema.gov/r-n-r/frp/frposh.htm](http://www.fema.gov/r-n-r/frp/frposh.htm)) addresses, through the Occupational Safety and Health Support Annex, the matter of safety and health of “federally deployed personnel” including “employees and volunteers with recognized voluntary organizations.” While the FRP operates under the Incident Command System (ICS) based upon the fire and rescue community model (1910.120(q) actually), it does not specifically address “skilled support personnel” as identified in 1910.120(q)(4). It may be appropriate to evaluate the clarity of the FRP and OS&H Support Annex with specific regard to applicability to skilled support personnel and such personnel as

volunteers in light of the protracted and extremely hazardous search and rescue phase of the WTC disaster operations.

This effort has not, however, been without an impact on the workers involved in it. The intensity of the effort, long hours, continual work seven days a week for over three and half weeks has resulted in severe stress and fatigue, and a high rate of injury and illness among those workers. Based upon the “World Trade Center Worker Injury and Illness Surveillance Update” (Reference 10), published daily by the NYC Department of Health, dated September 26, 2001 “Construction” workers suffered 995 injuries/illnesses over the twelve day period from September 14 through September 25, 2001. The data released in the “Surveillance Update” does not, however, have the detail necessary to determine what of the adverse outcomes are “reportable” under the OSHA standards. However, if only 10% are “reportable,” it is evident that the injury and illness rate for work at the Site over this period is far above the national average for construction reported by the BLS for 1999 (8.6) or, for that matter, typical large and complex construction projects. There may be longer term value to a detailed examination of the records supporting the Surveillance Report as a basis for developing recommendations for future reporting by public health agencies so as to aid rescue, cleanup, and removal construction S&H professionals in improved targeting of interventions based upon emerging adverse outcomes.

Once the WTC Disaster Site ES&H Plan and the prime cleanup contractors ES&H Plans are released, the worker training requirements can be identified. The grantee organizations will face significant challenges in providing the required training, as it is highly unlikely that the cleanup work will stop in order to accommodate the training delivery needs. As an example, the recently imposed requirements for specific levels of protection for workers in the rubble zone requires the use of half mask APR’s. Of the 1350 or so construction workers on the Site, it is probable that fewer than 20 % have been medically certified to wear respiratory protection or have had respirator training. The training delivery efforts by the grantee organizations involved must be as dedicated as have the workers engaged in the rescue and recovery effort. The workers involved need that dedication and clearly, based upon the injury/illness statistics, need that training.

**REFERENCES: (Reference links to 1-13 are located on [www.wetp.org](http://www.wetp.org))**

1. [WTC Disaster Project](#). 9-23-01
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4. [WETP listing of relevant training courses](#) available to support the WTC response and the NIEHS supported organizations available to provide those resources. September 25, 2001.
5. WETP compilation of WTC disaster relevant training courses delivered and workers trained in NY and NJ from September 1, 2000 to August 31, 2001.
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[www.hazmat.org](http://www.hazmat.org)

[www.cdc.gov](http://www.cdc.gov)

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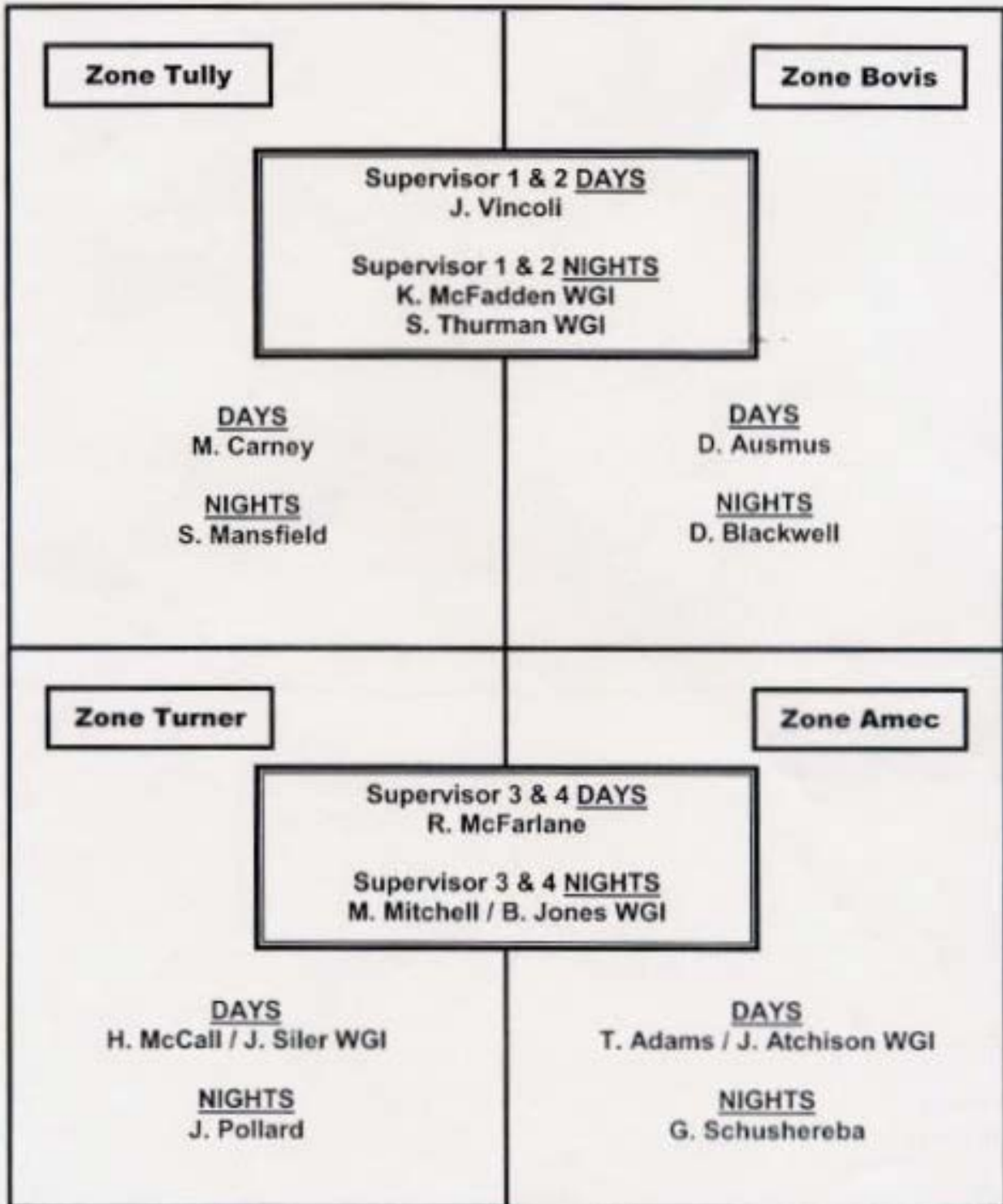
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[www.firstgov.gov/featured/usgresponse2.html#agencies](http://www.firstgov.gov/featured/usgresponse2.html#agencies)



# WTC DISASTER PROJECT



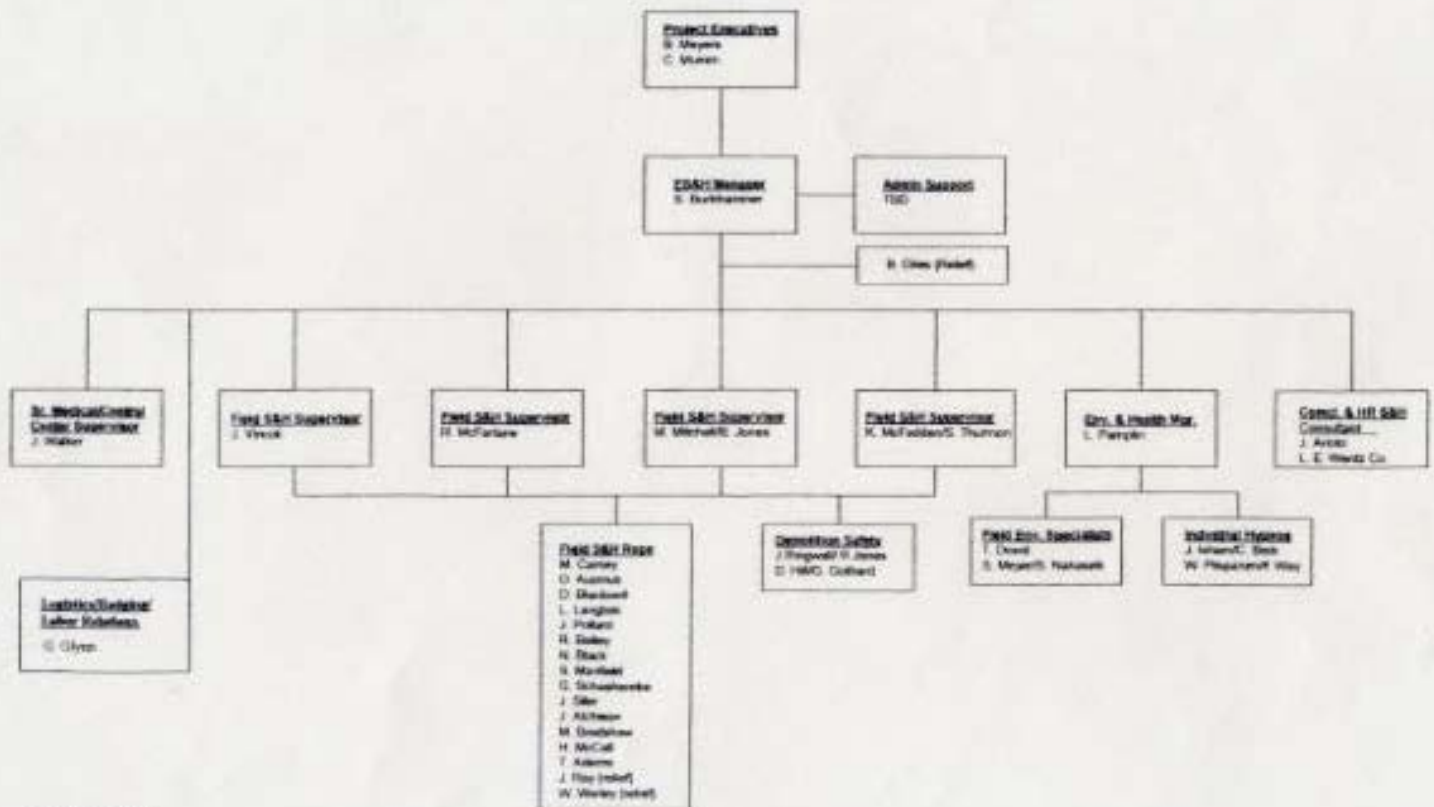
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Mark Langlois – NIGHTS

*Relief:* Wade Worley, Norm Black, Jerry Ray  
Rick Callor

*Demolition:* J. Ringwall / R. Jones WGI  
D. Hill/ G. Gothard WGI

9-23-01

**WTC Disaster Project**  
**Environmental, Safety, and Health Oversight Team**  
 469 Seventh Avenue, Floor 6  
 New York, NY 10018  
 301-536-3422  
 301-908-6809



Estimated Number of Personnel Working Daily at the World Trade Center Disaster Site

Organization/type of worker (Source of information)	Daily total	Comments
Fire Department (John Clair, Asst. Chief— 718-999-2696)	1200	425 (range 250-600)/tour x 10 hours/tour 125/tour @ 12 hours/tour
Police Department <sup>1</sup> (Capt. Feranda— 718-760-7624)	2000	1000/tour @ 12 hours/tour (includes 100-200/ tour on the "bucket brigade" and 117/tour for the Emergency Services Unit, including K-9)
Urban Search and Rescue (USAR; Mark Stinson—202- 297-7357) <sup>2</sup>	496	There are eight 62 member teams, working 12 hours/tour
Construction <sup>3</sup>	1350	AMEC 150/tour @ 8 hours/tour Bevis 100/tour @ 8 hours/tour Tully 150/tour @ 12 hours/tour Turner 150/tour @ 12 hours/shift
Sanitation Department	85	
TOTAL	5135	Other organizations may warrant inclusion in the estimated denominator for illness and injury daily rate calculations and resource planning.

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<sup>1</sup> Police officers are engaged in either search and rescue or site/perimeter security. The risk of injury varies by type of activity.

<sup>2</sup> One of my notes for 9/18 indicates that there were ~2000 USAR responders at the Yale Building on 9/17.

<sup>3</sup> Estimates were originally provided by NYC Department of Design and Construction and subsequent verified by company representatives at the 9 am morning meeting with prime contractors.

**AIR SAMPLING AT THE WORLD TRADE CENTER SITE  
BY THE OPERATING ENGINEERS NATIONAL HAZMAT PROGRAM  
SEPTEMBER 27, 2001 UPDATE  
Bruce Lippy, CIH, CSP**

## **INTRODUCTION**

The **Heavy Equipment Operators** of the International Union of Operating Engineers (IUOE) continue to play a critical role in the clean-up of the World Trade Center terrorist attack site. The amount of debris on the site has been significantly reduced by the round-the-clock efforts of the Operating Engineers and other dedicated craft workers on site. The amount of dust released on the site has been lessened since last week but the fires continue to release smoke, sometimes more heavily than during the previous week. Operating Engineers have been moving their equipment further onto the large debris pile and, therefore, experiencing longer and more intense exposures to the smoke.

The IUOE National Hazmat Program has had a team of Industrial Hygienists collecting daily air samples of operator exposures since Wednesday, September 19<sup>th</sup>. The team has collected over 50 samples of potential contaminants, including airborne asbestos, lead, total dust, organic vapors, and acid gases. The IUOE National Hazmat Program's technical office in Morgantown, West Virginia has been compiling the data every day and then disseminating it over the Internet to the New York City Department of Health, the EPA, and the National Institute of Environmental Health Sciences. The team has also been reviewing the data collected by federal and state organizations.

## **RESULTS OF THE IUOE SAMPLING**

All of the samples were collected inside the open cabs of heavy equipment operated onsite. Most of the results have been acceptably low, generally well below any applicable OSHA standard or National Institute of Occupational Safety and Health (NIOSH) recommendation. Several samples for asbestos that were analyzed by transmission electron microscopy, however, were well in excess of the EPA final clearance level for asbestos abatement projects. A bulk sample of settled dust showed 0.6 percent asbestos, which is below the 1.0 percent level that EPA considers asbestos-containing material.

The highest result for airborne lead was only one-tenth of the level set by OSHA. Most of the readings were below the limit of detection for the method. A bulk sample of the dust showed approximately 120 parts per million (ppm) of lead. As a reference point, the EPA considers 400 ppm to be a level of concern for lead in soils where children play.

All the measurements of total dust were well below the OSHA standard of 15 mg/m<sup>3</sup>. The highest reading at the World Trade Center was 3.2 mg/m<sup>3</sup>.

The team measured parts per billion concentrations of several organic chemical vapors in the cabs of the equipment, including acetone, hexane, and benzene. Each of the three

organic vapor samples also picked up Freon, which is a refrigerant, used in the air conditioning systems of the buildings. There are reported to be several large tanks of Freon in the basement of the building that are thought to be intact but that has not been confirmed.

## **RESULTS OF SAMPLING BY OTHER ORGANIZATIONS**

Other organizations are reporting results similar to those obtained by the IUOE. Of particular note, the EPA has picked up several ambient air samples for asbestos that were analyzed by transmission electron microscopy and also exceeded the EPA clearance level for asbestos abatement. They have found that levels have been generally getting lower, however. Most of the sampling that has been conducted for asbestos around the site has been analyzed by optical microscopy, which is not as sensitive.

The EPA has also reported finding three elevated readings for lead and three for chromium. It is important to note that the EPA's acceptable level for lead is considerably lower than OSHA's because the agency is concerned with long term exposure of the general public, not work exposure.

The EPA has noted that all four of the samples taken for dioxin on September 16<sup>th</sup> showed all levels at or above the EPA's removal action guideline, which is based on a 30-year, 24-hour exposure risk scenario. The samples were reported to have been collected directly in the plume of smoke. Dioxin is an extremely toxic compound and is generated by combustion of plastics.

## **CONCLUSIONS**

The results of the air sampling conducted by the IUOE and by others support the earlier recommendation by the IUOE's team that Operating Engineers should be wearing respiratory protection. The results indicate that the half-face respirator with high efficiency dust cartridges that also protect against organic vapors and acid gases (P100/OV/AG) are sufficiently protective. This is also the conclusion of NIOSH in a policy statement from September 27, 2001.

There has been disagreement among some agencies about the necessity of protection against organic vapors and acid gases because the levels measured have been generally low. The position of the IUOE team is that the potential exposure to dioxin in the smoke warrants organic vapor protection. Additionally, the cartridges will protect against odors from bodies. The presence of large quantities of Freon means that hydrochloric and hydrofluoric acid can be generated in the presence of heat. Consequently, workers need to be protected from acid gases, too.



# Air Monitoring Overview

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Presented to Dr. Kenneth Olden

Presented by Bruce Lippy, CIH, CSP

Operating Engineers National Hazmat



# Most Recent Data

## Asbestos

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- EPA has collected 442 ambient air samples for asbestos from 16 stations, 27 were above AHERA standard (6%).
- EPA and OSHA collected 177 bulk samples, 48 were >1% asbestos (27%)
- IUOE has collected inside cab TEM samples and has documented levels above AHERA in roughly one-third
- One sample was a 0.7 s/cc concentration but all small fibers.



# Dioxin

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- EPA collected 4 stations for dioxin on Sept. 16<sup>th</sup>
- Levels were at or just above the EPA standard for action (30 year exposure)



# Metals

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- OSHA has taken 53 samples of metals including lead, iron oxide, zinc oxide, copper and beryllium
- All were below the OSHA PELs
- IUOE has documented lead in the dust around 120 ppm and airborne below 5ug/m<sup>3</sup>
- IUOE <LOD for cadmium, cobalt, chromium, magnesium, nickel, zinc, and iron oxide



# VOCs

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- Four OSHA samples exceeded PEL for benzene at 0.5 ppm
- Sample on 9-22 had a level of 3.2ppm
- EPA found 30 ppm at ground level in smoke
- IUOE found benzene in cabs but in ppb levels
- IUOE collected four TO15 EPA samples for broad scan of VOCs (60 cmpds) and found nearly all <LOD except acetone



# Carbon monoxide

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- OSHA took 9 personal samples 1-15 ppm, well below the OSHA PEL
- NIOSH reported grab samples for users of gas powered equipment approaching the IDLH level.



# Silica

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- OSHA collected 40 samples. Most <LOD highest was 50% of PEL
- OSHA collected several on Operating Engineers



# Freon

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- Freon has been picked up by several organizations
- IUOE found it in every cab sampled but in ppb levels.



**World Trade Center (WTC) Worker Injury and Illness Surveillance Update**  
September 26, 2001

**Background**

The purpose of this prospective surveillance is to determine the type of injury and illness occurring in individuals working at the WTC site. Information collected includes medical facility, triage class, basic demographic information, the individual's organization or employer type (for example "construction" or "military"), the activity at the time of injury, the type of injury or illness and disposition.

**Facilities Included in the Surveillance System:**

Bellevue Hospital Emergency Department  
Beth Israel Medical Center (Petrie Division) Emergency Department  
New York University Downtown Hospital Emergency Department  
St Vincent's Hospital Emergency Department  
DMAT - Disaster Medical Assistance Team

**Time Frame:** Starting 00:01 AM, 9/14/01 through 12:00 midnight 9/25/01.

**Surveillance Forms:**

Several changes have occurred in the surveillance form after receiving feedback from clinicians. As new options were added to the form, prior data was reclassified if possible.

**A. Changes to Injury and Illness type:**

1. The initial options included: abrasion, burn, concussion, contusion, crush, eye irritation/injury, fracture, laceration, other (specify), psychological stress, skin irritation/rash, smoke/dust inhalation, and sprain/strain.
2. Forms issued after 9/16/01 added: blister, dehydration, headache, heat exhaustion, and nausea/vomiting/diarrhea.
3. Forms issued after 9/17/01 deleted eye irritation/injury and smoke/dust inhalation, but added eye irritation, corneal abrasion, cough, SOB/wheezing and asthma exacerbation.
4. Forms issued after 9/19/01 added fever.

**B.** The section "Activity at the Time of Injury" was added to forms issued after 9/17/01

**C.** Questions asking about the use of respirators and eye protection were added to forms issued after 9/17/2001

**D.** In the following tables, all categories of eye injury are combined under "eye injury, combined" and cough, shortness of breath and smoke/dust inhalation are combined under "lung injury, combined"

**Observations:**

A. This update reflects data collected from 00:01 AM, 9/14/01 through midnight, 9/25/01. The totals for each day may change in subsequent updates as patient reports are collected and refined.

B. The total number of reports received is **3814**

C. The most common types of injuries and illness (with percent of total injury and illness):

	<b>Number (%)</b>
<b>Eye injury, combined</b>	509 (13%)
<b>Headache</b>	331 (9%)
<b>Blisters</b>	288 (8%)
<b>Lung injury, combined</b>	252 (7%)
<b>Sprain/strain</b>	231 (6%)

D. All the following tables reflect the number, not the rate of injuries reported.

**Table 1: Total Number of Visits, DMAT and Emergency Departments, by Day**

Facility	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Dsites*	Total	Percent
All DMAT sites	36	59	56	290	317	403	316	327	380	488	380	440		3492	92%
MS1/NORTH TX	36	59	56	122	51	41	37	40	39	26	35	46	588		
MS2/WEST TX	0	0	0	53	96	119	61	78	150	193	93	128	971		
MS3/LIBERTY	0	0	0	104	91	108	100	60	43	57	48	60	671		
MS4/CHURCH	0	0	0	3	76	134	97	125	105	135	139	131	945		
MS5/VESSEY	0	0	0	8	3	1	21	24	43	77	65	75	317		
Emergency Departments	76	48	34	32	35	25	25	13	9	12	7	6		322	8%
<b>Total</b>	<b>112</b>	<b>107</b>	<b>90</b>	<b>322</b>	<b>352</b>	<b>428</b>	<b>341</b>	<b>340</b>	<b>389</b>	<b>500</b>	<b>387</b>	<b>446</b>		<b>3814</b>	<b>100%</b>

\* Dsites = totals for individual DMAT sites, MS2 through MS5 opened 9/17

**Table 2: Illness and Injury Type at DMAT and Emergency Departments, by Day**

Injury/Illness	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Total	Percent
Abrasion	2	1	2	7	16	15	10	4	7	10	4	3	81	2%
Blisters	3	2	3	36	44	42	25	26	29	31	28	19	288	8%
Burn	0	0	2	9	8	10	12	13	9	11	8	6	88	2%
Chest Pain	4	1	2	5	1	4	3	1	1	2	2	0	26	1%
Concussion	0	1	0	0	0	0	1	0	1	0	1	0	4	0%
Contusion	3	6	2	5	3	3	2	4	2	6	2	3	41	1%
Crush	0	1	0	1	0	0	1	0	0	2	2	1	8	0%
Dehydration	0	4	0	2	1	3	0	1	0	0	1	0	12	0%
Eye injury, combined	19	13	22	108	72	67	46	40	35	39	24	24	509	13%
Fever	0	0	0	0	0	0	0	0	0	0	1	0	1	0%
Fracture	3	1	2	2	2	2	3	1	2	4	2	3	27	1%
Headache	1	4	4	11	23	40	39	19	39	55	44	52	331	9%
Heat Exhaustion	0	0	0	0	0	1	0	0	0	0	0	0	1	0%
Laceration	11	10	5	23	24	25	30	16	20	20	24	5	213	6%
Lung injury, combined	24	16	12	21	18	44	22	23	11	17	20	24	252	7%
Nausea/vomit/diarrhea	1	2	1	3	8	7	9	3	7	16	10	5	72	2%
Other (see table 2A)	8	18	20	47	74	93	59	117	110	141	78	126	891	23%
Psychological stress	2	2	1	5	4	0	4	4	3	2	2	20	49	1%
Skin irritation/Rash	4	9	2	9	11	17	14	12	16	17	19	30	160	4%
Sprain/Strain	27	15	9	17	28	24	23	19	16	24	18	11	231	6%
Unknown	0	1	1	11	15	31	38	37	81	103	97	114	529	14%
<b>Total</b>	<b>112</b>	<b>107</b>	<b>90</b>	<b>322</b>	<b>352</b>	<b>428</b>	<b>341</b>	<b>340</b>	<b>389</b>	<b>500</b>	<b>387</b>	<b>446</b>	<b>3814</b>	<b>100%</b>



**Table 2A: Category "Other Injury/Illness" (>5 Occurrences)**

<b>Injury/Illness</b>	<b>Number</b>
ALLERGY	20
BACK/LEG PAIN	24
BITE (ANIMAL/INSECT)	7
BLOOD PRESSURE CHECK	17
CONGESTION (NOSE/LUNG)	84
DENTAL	13
DIABETES	6
DRESSING CHANGE/SUTURE CARE	54
EAR INJURY	8
EXHAUSTION/FATIGUE	8
FLU-LIKE (FEVER/MYALGIA/SORE THROAT)	10
FOLLOW-UP CARE	6
FOOT INFECTION/FOOT INJURY NOS	61
FOREIGN BODY, NOT IN EYE	9
MEDICATIONS/SUPPLIES REQUEST	141
MUSCULOSKELETAL OTHER	63
OTHER	106
RESPIRATOR/GOGGLES/PROTECTIVE EQUIPMENT	109
SEIZURE	6
SORE THROAT/THROAT IRRITATION	50
STOMACH ACHE	39

**Table 3: Type of WTC Worker Seen at DMAT and Emergency Departments, by Day**

Type of Worker	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Total	Percent
Construction	10	9	14	59	75	119	99	81	115	146	126	142	995	26%
Fire	19	13	11	84	65	80	74	74	77	85	59	50	691	18%
Medical	9	7	8	6	9	8	11	21	8	13	12	26	138	4%
Military	2	13	4	6	9	25	13	11	14	17	10	19	143	4%
Other	29	27	16	39	31	33	27	40	58	91	63	84	538	14%
Police	36	33	30	103	115	122	87	61	74	100	66	75	902	24%
Red Cross	2	2	1	2	6	12	7	8	8	9	3	13	73	2%
Unknown	5	3	6	23	42	29	23	44	35	39	48	37	334	9%
<b>Total</b>	<b>112</b>	<b>107</b>	<b>90</b>	<b>322</b>	<b>352</b>	<b>428</b>	<b>341</b>	<b>340</b>	<b>389</b>	<b>500</b>	<b>387</b>	<b>446</b>	<b>3814</b>	<b>100%</b>

Table 4: Number of Injuries/Illness, by Injury Type and WTC Worker Type

Injury/Illness	Construction	Fire	Medical	Military	Other	Police	Red Cross	Unknown	Total
Abrasion	15	18	2	2	7	22	1	10	81
Bite	116	43	3	17	41	36	13	14	288
Burn	37	21	2	0	5	16	3	6	88
Chest Pain	4	2	1	0	10	0	0	2	26
Concussion	1	1	0	1	1	0	0	0	4
Contusion	7	8	1	2	6	15	0	2	41
Crush	2	1	1	0	2	1	0	0	8
Dehydration	1	1	0	1	2	1	0	2	12
Eye injury, combined	101	104	12	9	45	150	3	41	509
Fever	0	1	0	0	0	0	0	0	1
Fracture	7	3	2	2	3	6	2	0	29
Headache	82	73	14	14	44	71	2	30	331
Heat Exhaustion	0	0	0	1	0	0	0	0	1
Laceration	67	48	1	3	20	61	4	9	213
Lung injury, combined	40	64	12	8	39	66	3	15	252
Nausea/vomit/diarrhea	21	11	2	4	8	21	0	3	72
Other	208	120	41	16	135	178	19	104	861
Psychological stress	12	5	4	7	14	41	1	1	49
Skin irritation/Rash	46	24	4	6	32	36	5	7	160
Sprain/Strain	77	35	6	5	32	55	4	14	231
Unknown	140	76	22	11	92	108	13	67	529
<b>Total</b>	<b>995</b>	<b>691</b>	<b>138</b>	<b>143</b>	<b>538</b>	<b>902</b>	<b>73</b>	<b>334</b>	<b>3814</b>

**Table 4A: Police Injury/Illness by Day**

Injury/Illness Type	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Total	Percent
Abrasion	1	0	1	3	5	4	3	0	0	4	0	1	22	2%
Blister	0	1	1	4	8	8	3	1	2	5	3	0	36	4%
Burn	0	0	0	3	2	2	4	2	2	0	0	1	16	2%
Chest Pain	1	0	0	0	0	3	1	1	0	0	0	0	6	1%
Contusion	2	3	2	2	1	1	0	1	1	1	1	0	15	2%
Crash	0	0	0	0	0	0	0	0	0	1	0	0	1	0%
Dehydration	0	1	0	0	0	0	0	0	0	0	0	0	1	0%
Eye injury, combined	6	7	11	50	35	28	18	11	4	11	4	5	190	21%
Fracture	1	0	1	0	0	0	0	1	1	2	0	0	6	1%
Headache	0	1	1	1	7	14	9	2	9	7	6	14	71	8%
Laceration	3	4	3	6	12	9	9	3	1	5	5	1	61	7%
Lung injury, combined	7	7	5	8	3	16	6	1	2	2	5	6	68	8%
Nausea/vomit/diarrhea	1	0	1	0	3	2	4	0	2	7	1	0	21	2%
Other	3	2	2	16	23	18	15	18	26	22	14	19	178	20%
Psychological stress	0	0	0	1	1	0	1	1	1	2	0	4	11	1%
Skin irritation/Rash	0	3	0	0	4	4	4	5	1	4	5	6	36	4%
Sprain/Strain	11	4	2	8	7	3	3	6	3	3	2	3	55	6%
Unknown	0	0	0	1	4	10	7	8	19	24	20	15	108	12%
<b>Total</b>	<b>36</b>	<b>33</b>	<b>30</b>	<b>103</b>	<b>115</b>	<b>122</b>	<b>87</b>	<b>61</b>	<b>74</b>	<b>100</b>	<b>66</b>	<b>75</b>	<b>902</b>	<b>100%</b>



**Table 4B: Fire Injury/Illness by Day**

	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Total	Percent
Abrasion	0	0	0	3	6	5	0	2	1	1	0	0	18	3%
Blister	1	0	0	8	7	2	6	5	4	6	3	1	43	6%
Burn	0	0	1	4	4	2	2	2	3	1	2	0	21	3%
Chest Pain	0	0	0	1	0	1	0	0	0	0	0	0	2	0%
Concussion	0	0	0	0	0	0	1	0	0	0	0	0	1	0%
Contusion	0	1	0	2	0	1	1	1	1	1	0	0	8	1%
Crush	0	0	0	0	0	0	1	0	0	0	0	0	1	0%
Dehydration	0	1	0	0	0	0	0	0	0	0	0	0	1	0%
Eye injury, combined	4	1	2	36	10	10	10	11	11	5	3	1	104	15%
Fever	0	0	0	0	0	0	0	0	0	0	1	0	1	0%
Fracture	2	1	0	0	1	0	1	0	0	0	0	0	5	1%
Headache	0	0	1	5	3	5	12	6	10	16	8	7	73	11%
Laceration	4	1	1	8	1	6	8	6	4	5	2	2	48	7%
Lung injury, combined	3	3	1	6	3	12	8	8	2	5	6	7	64	9%
Nausea/vomit/diarrhea	0	0	0	0	3	0	1	1	1	2	2	1	11	2%
Other	1	3	3	7	14	27	7	23	18	21	10	16	150	22%
Psychological stress	1	0	0	0	2	0	0	0	0	0	0	2	5	1%
Skin irritation/Rash	0	1	0	1	3	0	6	1	4	4	2	2	24	3%
Sprain/Strain	3	1	2	1	7	5	7	4	2	2	0	1	35	5%
Unknown	0	0	0	2	1	4	3	4	16	16	20	10	76	11%
<b>Total</b>	<b>19</b>	<b>13</b>	<b>11</b>	<b>84</b>	<b>65</b>	<b>80</b>	<b>74</b>	<b>74</b>	<b>77</b>	<b>85</b>	<b>59</b>	<b>50</b>	<b>691</b>	<b>100%</b>

**Table 4C: Construction Injury/Illness by Day**

	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Total	Percent
Abrasion	0	1	0	1	1	4	2	1	4	2	3	0	19	2%
Blisters	0	1	1	16	17	20	8	11	12	12	12	6	116	12%
Burn	0	0	0	1	1	5	4	7	4	6	5	2	35	4%
Chest Pain	0	0	0	2	0	0	1	0	1	0	1	0	5	1%
Concussion	0	0	0	0	0	0	0	0	1	0	0	0	1	0%
Contusion	0	0	0	0	1	0	1	1	0	2	1	1	7	1%
Crush	0	0	0	1	0	0	0	0	0	1	1	0	3	0%
Dehydration	0	1	0	2	0	1	0	0	0	0	1	0	5	1%
Eye injury, combined	0	1	6	10	16	15	9	7	13	10	9	5	101	10%
Fracture	0	0	1	2	0	1	0	0	0	0	1	2	7	1%
Headache	0	0	0	0	3	12	13	3	7	16	12	17	83	8%
Laceration	1	1	1	4	6	7	8	5	12	8	13	1	67	7%
Lung injury, combined	2	0	0	0	3	7	6	2	4	8	4	4	40	4%
Nausea/vomit/diarrhea	0	0	0	2	2	5	3	0	2	3	2	4	23	2%
Other	0	2	1	11	13	12	15	27	24	37	23	43	208	21%
Psychological stress	0	0	1	2	0	0	1	1	0	0	2	5	12	1%
Skin irritation/Rash	0	0	1	0	2	8	2	4	7	2	7	13	46	5%
Sprain/Strain	7	2	1	3	6	10	9	8	4	13	9	5	77	8%
Unknown	0	0	1	2	4	12	17	4	20	26	20	34	140	14%
<b>Total</b>	<b>10</b>	<b>9</b>	<b>14</b>	<b>59</b>	<b>75</b>	<b>119</b>	<b>99</b>	<b>81</b>	<b>115</b>	<b>146</b>	<b>126</b>	<b>142</b>	<b>995</b>	<b>100%</b>

**Table 5A: Total Number of Injury/Illness at MSI/North TX**

Injury/Illness	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Total
Abrasion	0	1	1	2	1	0	4	0	0	1	1	0	11
Blister	2	2	3	16	12	4	1	0	6	1	4	2	53
Burn	0	0	0	3	1	0	1	2	0	0	2	2	11
Chest Pain	2	0	1	2	0	1	0	0	0	0	0	0	6
Confusion	1	2	0	1	1	0	0	1	0	0	0	0	6
Crush	0	0	0	0	0	0	1	0	0	0	0	1	2
Dehydration	0	1	0	1	0	3	0	0	0	0	0	0	5
Eye injury, combined	7	10	17	39	5	9	7	8	4	4	4	2	116
Fracture	0	0	1	0	0	0	0	0	0	0	1	1	3
Headache	0	4	4	6	1	0	2	1	1	0	4	3	26
Laceration	1	5	2	7	3	0	3	0	2	2	1	0	26
Lung injury, combined	7	8	5	4	2	7	2	6	2	3	3	2	51
Nausea/vomit/diarrhea	1	1	1	1	1	0	2	2	1	1	0	0	11
Other	4	9	14	24	10	15	1	7	8	8	3	14	117
Psychological stress	1	2	1	2	0	0	1	0	0	0	1	0	8
Skin irritation/Rash	4	7	2	6	2	1	3	2	2	1	4	2	36
Sprain/Strain	6	6	3	6	1	0	1	2	1	3	1	1	31
Unknown	0	1	1	2	11	1	8	9	12	2	6	16	69
<b>Total</b>	<b>36</b>	<b>59</b>	<b>56</b>	<b>122</b>	<b>51</b>	<b>41</b>	<b>37</b>	<b>40</b>	<b>39</b>	<b>26</b>	<b>35</b>	<b>46</b>	<b>588</b>

**Table 6A: Type of WTC Worker Seen at MSI/North TX, by Day**

Type of Worker	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Total
Construction	3	7	13	19	10	5	7	8	15	7	9	7	110
Fire	8	3	6	28	8	2	3	2	3	5	3	4	75
Medical	7	5	5	4	3	1	0	1	2	1	4	12	45
Military	1	7	4	2	1	5	1	5	2	1	0	1	30
Other	6	16	9	21	4	9	2	7	8	3	9	7	101
Police	8	17	14	44	21	15	17	10	4	6	8	4	168
Red Cross	2	1	1	1	2	0	2	1	0	1	1	1	13
Unknown	1	3	4	3	2	4	5	6	5	2	1	10	46
<b>Total</b>	<b>36</b>	<b>59</b>	<b>56</b>	<b>122</b>	<b>51</b>	<b>41</b>	<b>37</b>	<b>40</b>	<b>39</b>	<b>26</b>	<b>35</b>	<b>46</b>	<b>588</b>

**Table 5B: Total Number of Injury/Illness at MS2/West TX**

*Note: MS2 opened on 9/17/01*

Injury/Illness	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Total
Abrasion	1	4	4	0	2	1	5	0	0	17
Blister	9	19	19	10	12	9	19	9	8	114
Burn	4	4	1	4	3	4	6	2	0	28
Chest Pain	0	0	1	0	1	1	1	0	0	4
Contusion	0	0	1	0	0	0	3	0	2	6
Crush	0	0	0	0	0	0	1	0	0	1
Eye injury, combined	27	19	20	10	11	12	16	6	7	128
Fracture	0	0	1	0	0	0	2	0	1	4
Headache	0	4	17	5	0	18	21	9	18	92
Laceration	4	7	10	3	7	5	3	6	1	46
Lung injury, combined	0	6	13	4	7	3	5	4	5	47
Nausea/vomit/diarrhea	0	0	1	1	0	1	12	1	2	18
Other	3	20	16	5	12	58	54	24	28	220
Psychological stress	0	0	0	1	1	1	0	1	19	23
Skin irritation/Rash	1	2	3	2	6	6	7	5	8	40
Sprain/Strain	2	8	7	3	4	4	9	6	2	45
Unknown	2	3	5	13	12	27	29	20	27	138
<b>Total</b>	<b>53</b>	<b>96</b>	<b>119</b>	<b>61</b>	<b>78</b>	<b>150</b>	<b>193</b>	<b>93</b>	<b>128</b>	<b>971</b>

**Table 6B: Type of WTC Worker Seen at MS2/West TX, by Day**

*Note: MS2 opened on 9/17/01*

Type of Worker	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Total
Construction	16	29	47	29	32	41	60	29	52	335
Fire	7	25	15	6	22	19	19	14	13	140
Medical	0	1	2	4	4	3	2	1	6	23
Military	2	4	5	2	1	7	13	3	8	45
Other	0	7	10	4	5	28	48	17	21	140
Police	23	15	31	11	7	36	38	11	19	191
Red Cross	0	3	3	1	1	5	2	1	2	18
Unknown	5	12	6	4	6	11	11	17	7	79
<b>Total</b>	<b>53</b>	<b>96</b>	<b>119</b>	<b>61</b>	<b>78</b>	<b>150</b>	<b>193</b>	<b>93</b>	<b>128</b>	<b>971</b>



**Table 5C: Total Number of Injury/Illness at MS3/Liberty**

*Note: MS3 opened on 9/17/01*

<b>Injury/Illness</b>	<b>9/17</b>	<b>9/18</b>	<b>9/19</b>	<b>9/20</b>	<b>9/21</b>	<b>9/22</b>	<b>9/23</b>	<b>9/24</b>	<b>9/25</b>	<b>Total</b>
Abrasion	3	10	6	3	1	2	1	1	2	29
Blister	11	4	12	6	4	3	0	5	4	49
Burn	2	1	5	4	3	1	0	1	1	18
Chest Pain	1	1	1	1	0	0	0	1	0	5
Contusion	2	0	0	0	2	0	1	0	0	5
Crush	1	0	0	0	0	0	0	0	0	1
Dehydration	0	1	0	0	0	0	0	0	0	1
Eye injury, combined	31	25	22	19	5	2	3	2	3	112
Fracture	0	0	0	1	0	0	0	0	0	1
Headache	3	7	7	11	2	1	10	6	8	55
Laceration	9	11	11	13	6	4	5	7	1	67
Lung injury, combined	9	3	5	1	2	1	2	2	5	30
Nausea/vomit/diarrhea	2	2	0	2	0	1	1	2	0	10
Other	16	11	16	20	17	13	15	6	27	141
Psychological stress	1	0	0	0	0	0	2	0	1	4
Skin irritation/Rash	2	4	8	5	1	0	2	1	5	28
Sprain/Strain	4	10	6	8	6	2	3	1	1	41
Unknown	7	1	9	6	11	13	12	13	2	74
<b>Total</b>	<b>104</b>	<b>91</b>	<b>108</b>	<b>100</b>	<b>60</b>	<b>43</b>	<b>57</b>	<b>48</b>	<b>60</b>	<b>671</b>

**Table 6C: Type of WTC Worker Seen at MS3/Liberty, by Day**

*Note: MS3 opened on 9/17/01*

<b>Type of Worker</b>	<b>9/17</b>	<b>9/18</b>	<b>9/19</b>	<b>9/20</b>	<b>9/21</b>	<b>9/22</b>	<b>9/23</b>	<b>9/24</b>	<b>9/25</b>	<b>Total</b>
Construction	19	13	26	22	18	11	15	23	21	168
Fire	42	17	22	29	14	10	15	5	3	157
Medical	2	1	1	2	2	0	5	2	4	19
Military	1	0	8	1	2	2	0	0	2	16
Other	10	3	1	7	4	5	6	4	15	55
Police	18	47	43	35	14	7	10	13	11	198
Red Cross	1	0	4	1	0	1	0	0	1	8
Unknown	11	10	3	3	6	7	6	1	3	50
<b>Total</b>	<b>104</b>	<b>91</b>	<b>108</b>	<b>100</b>	<b>60</b>	<b>43</b>	<b>57</b>	<b>48</b>	<b>60</b>	<b>671</b>

**Table 5D: Total Number of Injury/Illness at MS4/Church***Note: MS3 opened on 9/17/01*

Injury/Illness	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Total
Abrasion	0	0	4	3	0	2	1	0	0	10
Blister	0	9	7	7	6	7	10	7	3	56
Burn	0	2	4	1	4	4	4	3	2	24
Concussion	0	0	0	0	0	1	0	0	0	1
Contusion	0	1	0	0	1	0	0	2	0	4
Crush	0	0	0	0	0	0	1	0	0	1
Dehydration	0	0	0	0	0	0	0	1	0	1
Eye injury, combined	2	14	15	6	8	11	11	9	6	83
Fracture	0	0	0	0	1	1	0	0	0	2
Headache	0	10	15	19	13	14	20	20	19	131
Laceration	1	2	4	7	3	5	2	7	2	33
Lung injury, combined	0	2	12	9	5	3	4	7	9	51
Nausea/vomit/diarrhea	0	3	2	4	1	4	0	4	0	18
Other	0	28	43	24	75	23	55	21	33	302
Psychological stress	0	0	0	0	0	1	0	0	0	1
Skin irritation/Rash	0	3	4	4	1	3	3	3	5	26
Sprain/Strain	0	2	7	6	4	4	5	8	3	39
Unknown	0	0	15	7	3	22	19	47	49	162
<b>Total</b>	<b>3</b>	<b>76</b>	<b>134</b>	<b>97</b>	<b>125</b>	<b>105</b>	<b>135</b>	<b>139</b>	<b>131</b>	<b>945</b>

**Table 6D: Type of WTC Worker Seen at MS4/Church, by Day***Note: MS3 opened on 9/17/01*

Type of Worker	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Total
Construction	0	20	37	32	17	25	47	42	48	268
Fire	0	12	38	30	34	41	50	27	18	230
Medical	0	1	2	3	10	2	2	4	0	24
Military	0	3	6	4	2	1	3	6	4	29
Other	1	8	10	8	15	8	20	18	24	112
Police	1	14	22	13	19	19	20	29	30	167
Red Cross	0	1	3	2	3	0	3	1	0	13
Unknown	1	17	16	5	25	9	10	12	7	102
<b>Total</b>	<b>3</b>	<b>76</b>	<b>134</b>	<b>97</b>	<b>125</b>	<b>105</b>	<b>135</b>	<b>139</b>	<b>131</b>	<b>945</b>

**Table 5E: Total Number of Injury/Illness at MS5/Vessey***Note: MS3 opened on 9/17/01*

Injury/Illness	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Total
Abrasion	0	0	0	0	1	2	2	1	0	6
Blister	0	0	0	1	4	4	1	3	2	15
Burn	0	0	0	2	0	0	0	0	1	3
Contusion	0	0	0	0	0	0	1	0	1	2
Crush	0	0	0	0	0	0	0	1	0	1
Eye injury, combined	4	0	0	3	7	6	3	3	4	32
Fracture	1	0	0	0	0	0	1	0	0	2
Headache	2	0	0	2	2	4	4	5	4	23
Laceration	0	0	0	2	0	4	8	3	1	18
Lung injury, combined	0	2	0	1	1	2	1	4	3	14
Nausea/vomit/diarrhea	0	0	0	0	0	0	1	3	3	7
Other	1	1	0	4	3	6	7	23	24	69
Psychological stress	0	0	0	0	1	0	0	0	0	1
Skin irritation/Rash	0	0	0	0	2	4	4	6	10	26
Sprain/Strain	0	0	0	3	1	4	1	2	2	13
Unknown	0	0	1	3	2	7	41	11	20	85
<b>Total</b>	<b>8</b>	<b>3</b>	<b>1</b>	<b>21</b>	<b>24</b>	<b>43</b>	<b>77</b>	<b>65</b>	<b>75</b>	<b>317</b>

**Table 6E: Type of WTC Worker Seen at MS5/Vessey by Day***Note: MS3 opened on 9/17/01*

Type of Worker	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	Total
Construction	1	2	0	4	6	23	15	21	14	86
Fire	2	0	0	3	2	3	14	9	11	44
Medical	0	1	0	1	1	1	3	1	4	12
Military	1	0	0	3	1	0	0	1	4	10
Other	0	0	0	3	3	7	11	12	12	48
Police	4	0	1	3	7	5	23	4	11	58
Red Cross	0	0	0	0	3	1	2	0	9	15
Unknown	0	0	0	4	1	3	9	17	10	44
<b>Total</b>	<b>8</b>	<b>3</b>	<b>1</b>	<b>21</b>	<b>24</b>	<b>43</b>	<b>77</b>	<b>65</b>	<b>75</b>	<b>317</b>