

EXPLOSIVE ACCIDENT SUMMARY: WORLD WAR II

-by-

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ABSTRACT

The DoD Explosives Safety Board is developing an electronic data base which lists and characterizes explosive accidents stored in historical files. While this data base is far from complete now, it may someday serve as a standard reference for the complex anatomy of explosive incidents. Accidents exact a tragic value: their causes give us clues to prevent recurrence, and their effects provide insight to those who design safety into operating facilities. While accident investigations fail to quantify phenomena to the degree that we obtain from explosives testing, they painfully substantiate hazards and underwrite safety programs.

In the course of searching historical files, a summary of World War II explosive accidents appeared which may be of interest to the field. While the explosions listed in this collection are not presented in depth, many are detailed in the classic abstracts written in the 1940's by the Office, Chief of Ordnance. They are the foundation upon which the Ordnance Safety Program was built.

Many of these disasters may not be familiar even to those who served.

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BACKGROUND

The DDESB has accumulated a file of approximately 2,400 explosive accidents from around the world. The file was begun in the late 1940's by Dr. Ralph Ilsley and Mr. Bob Herman who drew upon the classic work of Ralph Assheton's "The History of Explosions," first published in 1930, which reported explosions characteristic of the dynamite and black powder days of the nineteenth century.¹ To Assheton's work, Ilsley and Herman added case histories of explosions from international sources and from accidents reported by the civilian and military authorities in the United States during the early 20th Century.

Dr. Ilsley compiled this collection into a work known as the "Explosion Log," so named because it "logs" distances from the seat of an explosion to points where various targets were located, describing the damage experienced by that target.

Aside from Ralph Assheton and Dr. Ilsley, C. S. Robinson of MIT compiled a similar damage log.² The blast effects of these three accident logs were compared in a paper written by this author in the minutes of the 2nd Australian Explosives Safety Seminar.³

The DDESB is in the process of listing its 2,400 accidents into a computer data base. When this task is completed, explosive events long obscured in history will emerge, bringing renewed opportunity for study, comparison and analysis. This paper presents a status report. This report will cover the World War II years, chosen as an easily identifiable period of history and because excellent records exist now, but may be on the verge of extinction.

EARLY ACCIDENT ABSTRACTS

The Safety and Security Branch of the Office, Chief of Ordnance, located in Chicago, in the early 1940's published 135 accident abstracts, detailing the causes, effects and corrective actions for explosive accidents occurring in the ammunition plant complex during the war years between 1941 and 1944. Obviously, these accidents are somewhat dated by the technology of the period.

These reports prompted the advance of explosives technology. They recommended discontinued use of super sensitive materials and processes; they suggested the protection of personnel from the direct exposure to blending, pressing and mixing operations; they outlined plans for improved engineering methods to prevent specific insults to explosives in process, and introduced material science studies to prevent incompatibility with them. They are worth the effort to study.

We also value these old reports because of the excellent techniques employed in investigation and analysis of accidental explosions. Findings and recommendations in these abstracts may be the foundation of the old Ordnance Safety Program, one of the first to bring the elements of engineering, accident analysis, development of procedures (SOP's), job training and the like into one cohesive management device.

This collection of accident abstracts continued beyond the war years through the Department of Army, Office, Chief of Ordnance, Washington D.C. which analyzed 252 explosions between 1945 and 1962. Some of these abstracts address explosive test programs and various conferences which examined specific problems such as the safe operation of melt units.

THE PRODUCTION BASE

Table 1 is a tabular list of production base accidents that were reported by abstracts and other Ordnance Corps files during World War II. While damage costs are also shown, remember that a home in World War II might cost 8 to 10 thousand dollars, and a new car about \$2,200. The total accident cost of \$4,457,464 for the 667 explosions and fires occurring in the production base during World War II might be increased by a factor of one hundred to reflect realistic costs today. The death toll was 314 people, about that number who might perish in traffic during a holiday week-end. This is a remarkable record when kept in perspective. (Estimates of fatalities as a result of hostilities in World War II amount to about 300,000 per month.)

Navy Depots and Production Plants. Much of the Navy's production base is also included in Table 1. Obviously, those Navy bases which did not report through the Ordnance Department were not included. The DDESB files contain seven reports with a total of 58 fatalities during the war years. Twenty six fatalities occurred at the old NAD Hastings, 11 at NAD McAlester and 8 at NAD Yorktown.

Installations are ranked below in terms of the number of fatalities experienced due to explosions in World War II.

Location	Incidents	Fatalities
1 Elwood Ordnance Plant	4	53 ^a .
2 Iowa Ordnance Plant	15	36 ^b .
3 NAD Hastings	3	26 ^c .
4 Triumph Explosives Co	41	23 ^d .
5 King Powder Co (All plants)	17	12
6 Portage Ordnance Depot	1	11 ^e .
7 NAD McAlester	1	11 ^f .
8 Cornhusker Ordnance Plant	2	7
9 Louisiana Ordnance Plant	16	7
10 Remington Arms Private Plant	6	7
11 Radford Ordnance Plant	26	7

PLANT DISASTERS

a. An explosion involving a building and 3 railcars of anti-tank mines with an explosives weight of 62,600 pounds of TNT, killed 49 and injured 67 on 5 June 1942. In terms of lives lost this was the most deadly explosion at the ammunition plants during World War II. Only 4 more were killed at the Elwood site during the rest of the World War II, despite the millions of tons of ammunition loaded there.

b. Five days after the attack on Pearl Harbor, the first World War II melt tower detonated at Iowa, killing 13 and injuring 53. Three months later on 4 March 1942, a second melt tower detonated with 22 fatalities and 84 injuries. The second accident caused a high loss of life because it occurred during shift change. These events were used to critically examine the safety of melt towers throughout the complex, resulting in hundreds of engineering changes and vast improvements in the operation of these units.

c. On 15 September 1944 a detonation of 550 tons of Torpex-loaded mines detonated in a Cooling Building with ten loaded railcars alongside, killing 10, and injuring 61. Barricaded on both sides, the blast carved a crater measuring 525 in length, 140 feet wide and 30 feet deep. Structural damage was registered at 3,500 feet, window breakage at 15 miles. Chunks of concrete weighing 500 pounds were thrown a mile. One was found at 7,300 feet.

A similar accident occurred in April of 1944 when Cooling Building 180, also barricaded on two sides, detonated, killing 8 and injuring 2. Two railcars alongside were involved for a total of 110,000 pounds of Torpex. Again, massive concrete fragments littered the area for a distance of 3,200 feet. Strangely, one man was killed by a missile at 1,300 feet. Severe structural damage to competent buildings occurred at 800 feet, weaker buildings such as warehouses were damaged at 1,700 feet. Due to a number of explosions of this nature, the U.S. Navy no longer uses Torpex.

d. In Elkton, Maryland the Triumph Explosives Company experienced a detonation in a granulator on 4 May 1943 which propagated to four buildings, killing 15 and injuring 64. No one in the plant was aware that explosives overloads had completely defeated Q-D separations. The area was not designed for the production rate required by the war.

e. This accident occurred in an earth covered magazine loaded with fragmentation bombs with a net explosives weight (NEW) of 40,759 pounds of TNT. There were 10 men in the crew and only one body found. A man working in another magazine crew was killed at a distance of 450 feet from the detonation.

f. The similarity between this accident and the one in

e. above is sinister. On 5 December 1944, while loading Torpex loaded bombs from a trailer into an igloo magazine, a detonation in the magazine propagated to the trailer, killing all 11 of the magazine crew.

These eight accidents are the most catastrophic events in the production base during World War II. One percent of the accidents in the production base accounted for 42.9 percent of the total fatalities. This factor underwrites the cardinal principle of explosives safety: expose only the fewest people to the lowest amount of explosives for the least amount of time.

The graphic at Figure 1 indicates this lesson was well understood during the war. While the number of incidents gradually increased from 1941 through 1945, the number of fatalities and critical injuries decreased markedly. Minor injuries also decreased. The 1942 they numbered 3.1 injuries per explosive accident. In 1943 the rate was down to 1 then went up slightly to 1.1 in 1944, finally dropping to less than 1 minor injury per incident in 1945. This overall statistical record is remarkable.

PLANT ACCIDENTS by TYPE of OPERATION

Table 2 lists each major type of operation in the ammunition production base by the number of explosions, deaths, injuries -- including the ratio of fatalities and injuries per event -- experienced for each one. The list is organized "worst first" based on the ratio of fatalities per event. As you might expect, melt units top the list. The list also tells us which accidents are more likely to happen regardless of fatalities. It shows why mixing, screening and pressing operations are accomplished remotely, and suggests why others, perhaps blending, should be. (Most blending operations are accomplished remotely today.)

The causes of selected plant accidents are listed at Table 3. These causes are taken from the DoD Case File 342. This file contains a listing by location of all plant accidents reported to the Ordnance Department, the dates, numbers killed and injured, and sometimes a one line cause statement.

ARMY ACCIDENTS, CONUS

Ten explosions are recorded at army bases during the war, with a total of 13 fatalities and 41 injuries.

ARMY AND U.S. MARINE CORPS EXPLOSIONS, OCONUS.

Twenty-six accidents around the world caused 108 fatalities and 130 injuries due to explosives accidents in deployed areas. Three explosions at Army Air Fields resulted in 16 fatalities, each, normally associated with handling 500 pound Bombs. Two accidents involving troops handling land mines, killed 16 and 14 respectively. These accidents occurred while retrieving mines

previously set by U.S. combat engineers. Bad weather and fatigue were factors in these events. These events occurred in deployed areas near combat zones.

SHIP EXPLOSIONS

The most disastrous events in the history of chemical explosives involve ships. The most significant explosive accident in this country during World War II occurred at NAD Port Chicago (Concord, California) when 3.75 million pounds of HE detonated in railcars, on the dock and aboard the USS E.A. Bryan, killing 325 and injuring 392. No one inside of 1,000 feet survived, and no one outside that distance perished. Damage was carefully documented by Bob Herman in DDESB Technical Paper 6.⁴ (AD 223344) Many of the current DoD Q-D standards are based on this report.

However the death toll on the USS Mount Hood was worse. This AE detonated in Seeadler Harbor, Manus Island in the Admiralties, just north of New Guinea on 10 November 1944 while crews were off-loading and on-loading ammunition from several barges at once.⁵ This detonation killed 378 servicemen, and injured 400. Twenty one smaller crafts within 500 feet of the blast, vanished. Ten ships were severely damaged within one half mile, and 26 other ships experienced fragment damage up to 6,600 feet. People ashore were knocked down at 2.5 miles.⁶

The disaster in Bari, Italy involving the SS Charles Henderson of U.S. registry, was yet worse. This detonation caused by handling 500 pound bombs loaded with Composition B, killed 542 and injured 1,800. It is believed the bombs were hooked and dragged to the well, then lifted without mats. The crew may have hurried because the contract paid by number of items lifted. Buildings along the waterfront were destroyed for 2,000 feet. Ships were severely damaged to 2,100 feet.

One of the more obscure accidents of the period happened in Pearl Harbor when 6 LCT's and 3 LTV's loaded with infantry ammunition, berthed side to side, caught fire during refueling operations. Within minutes detonations were propagating between barges while men attempted to move them out into the bay -- 127 were killed and 380 wounded.

A total of 12 accidental shipboard explosions were recorded during the war years with the devastating result of 1,817 fatalities and 2,777 injuries.

The Texas City explosion occurred in 1947 involving 5 million pounds of ammonium nitrate produced at the U.S. Ammunition Plants for the lend lease program. The ammunition plants manufactured ammonium nitrate for bomb fill. However, this is not included as a wartime incident. (The SS Fort Stickine in Bombay killed 741, injuring 2,000 during the war, but this was not a U.S. accident.)

SURFACE TRANSPORTATION ACCIDENTS

During World War II, railroads and trucking firms moved almost 10 million tons of ammunition and explosives. There were a total of 16 significant explosions and fires on rail lines with 2 fatalities reported. There were also 16 significant explosions involving truckloads of explosives, but 11 were killed.

The most striking of these events occurred at Selma, North Carolina on 7 March 1942 when a passenger car ran a stop sign and collided with a truck carrying 8,000 pounds of TNT and Teteryl. The truck drivers rescued the passengers from the burning car, but one of them died later. The fire department attempted, without success, to move the spectators away. A car with two passengers was actually driving past the burning wreck when it detonated, killing them. Fifty were injured in a dance hall 525 feet away. Two perished in a hotel fire 150 from the blast. Seventeen buildings were burned or structurally damaged, including a two story brick hotel. The final toll was 7 dead and 50 injured.

The record of transportation accidents involving ammunition and explosives is shown below. These numbers represent the total number of fires and explosions resulting from railroad and highway accidents in the period. The fatalities listed are those directly related to fire and explosions:

	<u>Railroad</u>		<u>Truck</u>	
	Events	Killed	Events	Killed
1942	1	0	2	8
1943	3	0	4	3
1944	7	1	5	0
1945	5	0	5	0
Total	16	1	16	11

SUMMARY

The following table of numbers will summarize the accidents considered by this report. There is no way to assure this record is complete, but its certainly the majority of significant incidents reported by U.S. authorities during the war years.

	<u>Incidents</u>	<u>Killed</u>	<u>Injuries</u>
Plants	667	314	9,000
Army (US)	10	13	41
Overseas	26	108	130
Ships	12	1,817	2,777
Transport	32	13	-
	747	2,265	4,033

HISTORICAL SOURCES

1. The Accident Log by Dr. Ralph Ilsley, 1796-1952: Lists damage logs for 384 cases. Ilsley's Log opens with Mr. Assheton's list of accidents (Ref 1), then adds those cases reported to DoD from various sources around the world, including many from within the Services. About 130 of these cases report World War II events.
2. The Department of Army Office of the Safety and Security Branch, Office of the Chief of Ordnance, Chicago, IL 1942-1944: These abstracts list 135 ammunition plant accidents including Government Facilities, Government-Owned-Contractor-Operated (GOCO) plants as well as private installations without dates or locations.
3. The Department of Army Office of the Chief of Ordnance, Wash DC, 1945-1962: These abstracts, listing 252 cases, echo those started in 1942. They are included only for reference since they cover the time after 1945.
4. The Army-Navy Explosives Safety Board, Wash DC 1944-1946: These one page abstracts report 38 World War II accidents from around the world.
5. Ordnance Field Safety Office, U.S. Army, Jeffersonville, IN, 1940's: These abstracts record about 55 cases, but are not always complete. Fortunately they duplicate other reports.
6. DoD File 1070. This is a comparison of truck versus rail transportation accidents involving ammunition and explosives from 1941 thru 1955. This information was gathered by an attorney for a lawsuit in the 1950's involving the safety records of railroads and truck companies.
7. DoD File 340. This file includes the history of World War II explosion and fires occurring in the production base

THE FUTURE OF ACCIDENT REPORTING

The accidents outlined above are prime examples of total system loss. They demonstrate the unraveling of management objectives, ultimate failures of communication; the weakening or loss of an entire span of human control. They combine horror with grief and tragedy. They destroy the workplace and cause loss of mission and pride of accomplishment. And, of course, they kill. Explosive accidents may, in fact, define the limits of human ability.

There is only one good thing, one truly positive aspect that may come from an explosive accident: the salient fact which may be

the key to preventing the next one, or to protect us from it. There is no other reason to exhume the events in this paper. We owe it to those who have gone before us, and to their families. It is the only debt we can pay. We may prevent future tragedies only when accidents are reported, analyzed and studied in a rational light.

Today, the system for reporting and analyzing accidents is hampered by threat of litigation. This threat inhibits both the gathering and reporting of evidence surrounding accident causes and effects. From the pure safety standpoint, establishing blame for an accident has little or no value in accident prevention.

There is a natural tendency to seek fault in those most closely associated with an accident. There may be a psychological need for this. But an accident is always a fault. Without human error there would be few, if any, accidents depending upon your definition.

(Webster: "2a: A sudden event or change occurring without intent or volition through carelessness, unawareness, ignorance, or a combination of causes and producing an unfortunate result "

This should be the premise, not the conclusion of accident investigations. We should discover unsafe acts before the explosion, including carelessness and failure to observe procedures -- these facts should be a matter of record along with the plans for corrective action. After the blast, the careless operators -- the uninstructed ones, may be gone, and the blame is moot. The primary reason for the the safety professional to study explosive accidents is the search for preventive measures, not blame.

The data base runs at the appendix may not list all the accidents reported in the body of this report, so the totals will not always match.

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TABLE 1

EXPLOSIVE ACCIDENTS IN U.S. FACILITIES DURING WORLD WAR II
(Including Fires Involving Energetic Materials)

Year	Incidents	Deaths	Critical	Injured	Cost
1941	8	15	10	42	\$369,307
1942	95	148	58	295	\$1,310,415
1943	223	88	72	219	\$1,253,119
1944	268	53	15	321	\$1,303,640
1945*	73	10	11	42	\$220,983
Total	667	314	166	919	\$4,457,464

U.S. Facilities Included in this Table

Both Private & Government-Owned Ammunition Plants
Arsenals, Depots, Test & Proving Grounds

TABLE 2

CATEGORIES OF WORLD WAR II PLANT ACCIDENTS

Type	Events	Deaths	Injuries	Fatals per Event	Injury per Event
Melt Units	5	46	122	9.2	24.4
Pack Out	15	81	182	5.4	12.1
Magazine Storage	4	17	3	4.3	0.8
Assembling	20	72	151	3.6	7.6
Blending	11	13	49	1.2	4.5
Rework	7	8	12	1.1	1.7
Maintenance	10	9	118	0.9	11.8
Burning Ground	21	17	22	0.8	1.0
Transfer	6	4	8	0.7	1.3
Transportation	11	7	10	0.6	0.9
Laboratory	8	5	4	0.6	0.5
Testing	15	9	25	0.6	1.7
Dry House	14	7	10	0.5	0.7
Loading	19	8	49	0.4	2.6
All Other	117	48	229	0.4	2.0
Nitration	24	9	28	0.4	1.2
Ready Storage	20	7	20	0.4	1.0
Screening	22	6	6	0.3	0.3
Drying	8	2	2	0.3	0.3
Mixing	34	7	14	0.2	0.4
Hammer Mill	6	1	3	0.2	0.5
Charging	12	2	17	0.2	1.4
Drilling	7	1	23	0.1	3.3
Pressing	44	6	57	0.1	1.3
Pelleting	8	1	2	0.1	0.3
Roll Mills	12	1	8	0.1	0.7
Grinding	12	0	2	0.0	0.2
Totals	492	394	1176	0.8	2.4

TABLE 3
CAUSES OF SELECTED PLANT ACCIDENTS

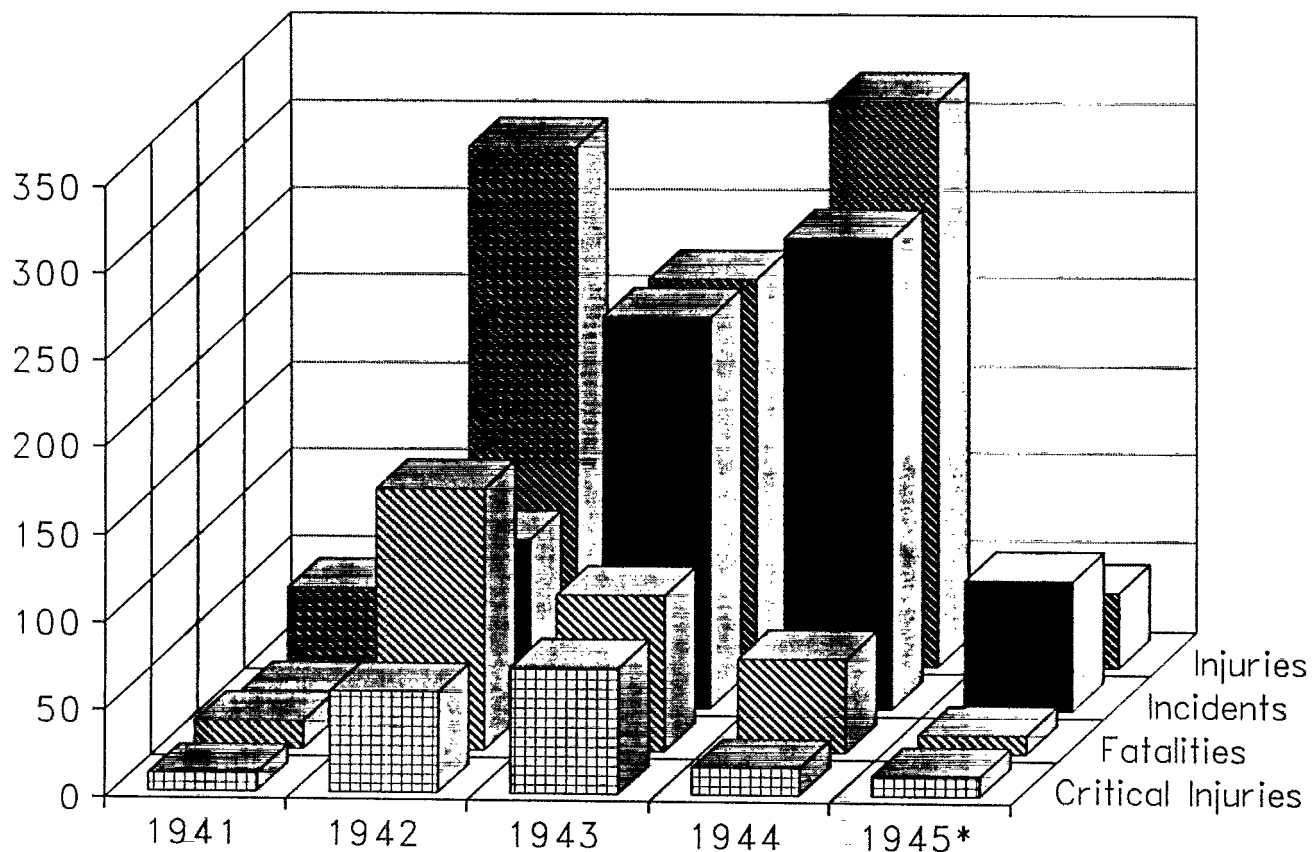
Unknown	221
Procedural	107
Heat	42
Static/Spark	42
Impact/Friction	48
Dropped/Fell	12
Tramp Material	11
Mechanical	22
Lightning/Storms	17
Maintenance	11
Various Specific	11
Total Examined	544

Keys:

Unknown:	Either evidence inconclusive, or no investigation was conducted.
Procedural:	Human error, SOP violation, regulation violated.
Heat:	Fires, spontaneous ignition, flame production
Static/Spark:	Static discharge, spark from flames or any other source.
Friction: (Impact)	All causes linked to these insults.
Dropped/Fell:	Explosive bumped or dropped, or when something fell on explosive.
Tramp Material:	Foreign material in process, such as grit or metal.
Mechanical:	Leaks, metal breakage, valve failures, press failures (shots)
Lightning: (Storms)	Caused by lightning effects, winds or other storm related phenomena
Maintenance:	Working on explosives contaminated equipment or facilities.
Various:	Design errors, cigarettes, chemical reactions, deterioration of explosives.

ACCIDENTAL EXPLOSIONS IN US FACILITIES

Ammunition Production Base



World War II Explosions
Army Class 1 Installations

Installation	Location	Date	Type	Items	Operation	Dead	Injured
Air Field	Chelveston	UK 09/03/43	Combat	Bombs, M43	Aircraft, B-17F Bomber	0	0
Ft Benning	Ft. Benning, GA	US 07/29/44	Storage	Ammunition, Smoke	Magazine, Igloo	0	0
Camp Blanding	Camp Blanding, FL	US 09/06/44	Storage	Grenade, M15, M1	Open Stacks	0	0
Firing Range	Algiers	DZ 10/22/43	Range	Projectile, M107	Howitzer, 155mm	8	6
Camp Beal	Camp Beal, CA	US 08/19/43	Training	Bomb, Demolition	Fighter A/C P-30	2	0
Henderson Field	Guadalcanal	US 11/27/44	Storage	Ammunition	Open Storage	1	0
Tactical Mine Field	Wittring	FR 01/19/45	Loading Truck	Mines, AT	Truck	16	10
Ft Knox	Ft Knox, KY	US 07/19/42	Storage	Mortar, 81mm, Gun, 75mm	Magazine, Igloo No 14	0	0
Army Air Field	Medfield	UK 07/15/44	Loading Truck	Bombs, GP 1000 lbs	Trucks	0	0
Mitchell Field	Long Island, NY	US 01/01/42	Aircrash	Bomb, GP 500 lb	Aircraft, B-25 Bomber	5	0
Army Air Base	Navarin	DZ 06/26/43	Loading Truck	Bombs 500 lb	Open Storage Pads	16	0
Field Operation	APO 958	05/17/45	Maintenance	Fuze, M600, Chemical		0	0
Camp Polk	Camp Polk, LA	US 06/16/44	Storage	Projectile, 155mm	Magazine, Igloo	0	0
Camp Pickett	Camp Pickett, VA	US 11/04/43	Handling UXO	Rocket, HE, M6A1	Training Range	5	38
Army Air Force Station	Ridgewell	UK 07/29/43	Combat	Bombs 500 GP	Aircraft, B-17 Bomber	23	0
East Field	Saipan	01/19/45	Aircrash	Bombs, 500 lb SAP	Open Storage	15	38
Air Field	Deenethorpe	UK 06/12/44	Loading A/C	Bombs, Frag	Aircraft	0	0
Mine Field	Camp Breckinridge, KY	US 08/09/44	Training	Mine, AT	Mine Field	0	1
Mine Field	Fornace	IT 01/08/45	Combat	Mines, AT	Mine Field	14	18
Army Air Field	Chelveston	UK 08/27/43	Combat	Bombs, 500 lb	Aircraft, B-17 Bomber	0	0
*** Total ***						105	111

World War II Explosions
Ships

Installation	Location	Date	Type	Items	Operation	Dead	Injured
SS Charles Henderson (US)	Bari	IT 04/09/45	Loading Ship	Bombs, 500 lb AN-M64	Dockside Cranes	542	1800
SS John Burke (US)	Pacific Theatre	12/28/44	Combat	Bombs, HE & WP	Ship & LST's	300	23
USS Colorado	Iwo Jima	JA 04/20/45	Loading Ship	16" Charge, Mk 5 Tank	Ships Magazine	1	3
SS John M Brook (US)	Bari	IT 03/02/45	Loading Ship	Bombs	Loading tray	0	4
USS South Dakota	Pacific Theatre	05/06/45	Loading Ship	16" Chg, Mk 5 Tank	Ships Magazine	11	22
SS El Estero	Caven Point, NJ	US 04/24/43	Trans	Ammunition	Ship	0	0
USS Serpens	Guadalcanal	US 01/29/45	Loading Ship	Bombs	Ship	194	15
USS Hancock	China Sea	01/21/45	Combat	Bomb, 500 lb, GP, AN-M64	Flight Deck	50	81
LTV Alongside USS Latimer	South Pacific	12/21/44	Tactical Ship	Grenades, Rifle, Thermate	LTV	0	0
NAD Port Chicago	Concord, CA	US 07/17/44	Loading Ship	Ammunition	USS E A Bryan	325	392
Seeadler Harbor	Manus Island, Admiralties	AS 11/10/44	Loading Ship	Ammunition	USS Mt Hood	378	400
Pearl Harbor	Pearl Harbor, HI	US 05/21/44	Loading Barge	Ammunition	6 LST's & 3 LCT's	127	380
*** Total ***						1928	3120

World War II Explosions
Navy Installations Ashore

Installation	Location	Date	Type	Items	Operation	Dead	Injured
NAD Hastings	Hastings, NE	US 04/06/44	LAP	Bombs and Mines	Cooling Building	8	2
NAD Hastings	Hastings, NE	US 09/15/44	Loading Railcar	Bombs, Depth	Transfer Dock	10	56
NAD Hastings	Hastings, NE	US 07/19/45	Disposal	Bombs	Demolition Area	8	0
NAD Hawthorne	Hawthorne, NV	US 03/03/45	Storage Ops	Box of Gas Tank Igniters	Magazine, Igloo	0	0
NAD McAlester	McAlester, OK	US 12/05/44	Storage Ops	Torpedo Warheads	Magazine, Igloo	11	0
NAS Norfolk	Norfolk, VA	US 09/17/43	Trans	Depth Bombs, AN-Mk47	Airfield Taxiway	27	399
NAD Oahu	Oahu, HA	US 06/11/44	Storage Ops	Torpedo Whds (Air & Sea)	Magazine, Tunnel Type	10	3
NPP Indian Head	Indian Head, MD	US 04/19/45	Mfg	Single Base Smokeless	Solvent Recovery	3	0
NAD Yorktown	Yorktown, VA	US 11/16/43	Loading Truck	Mines, M-16-1	Warehouse	8	6
*** Total ***						85	466

World War II Explosions
High Injury & Death Toll

Installation	Location	Date	Type	Items	Operation	Dead	Injured
Louisiana Ordnance Plant	Ordnance Plant, LA	US 11/27/42	LAP	Bomb M58 (Fragmentation)	Unapproved Tool	5	25
Camp Pickett	Camp Pickett, VA	US 11/04/43	Handling UXO	Rocket, HE, M6A1	Training Range	5	38
Highway	Selma, NC	US 03/07/42	Trans	Bursters M5	Tractor Trailer	7	50
NAD Hastings	Hastings, NE	US 04/06/44	LAP	Bombs and Mines	Cooling Building	8	2
NAD Hastings	Hastings, NE	US 07/19/45	Disposal	Bombs	Demolition Area	8	0
NAD Yorktown	Yorktown, VA	US 11/16/43	Loading Truck	Mines, M-16-1	Warehouse	8	6
Cornhusker Ordnance Plant	Grand Island, NE	US 05/26/45	LAP	TNT Molten	Melt Pour	9	6
Ammunition Dump, Okinawa	Okinawa Island	JA 07/10/45	Loading Truck	Mines, Japanese	Open Storage	9	0
NAD Hastings	Hastings, NE	US 09/15/44	Loading Railcar	Bombs, Depth	Transfer Dock	10	56
NAD Oahu	Oahu, HA	US 06/11/44	Storage Ops	Torpedo Whds (Air & Sea)	Magazine, Tunnel Type	10	3
NAD McAlester	McAlester, OK	US 12/05/44	Storage Ops	Torpedo Warheads	Magazine, Igloo	11	0
Portage Ordnance Works	Ravenna, OH	US 03/24/43	Storage Ops	Bombs, Frag M-41	Magazine, Igloo	11	3
Ordnance Plant	East Rochester, NY	US 09/06/42	Mfg	Flare Comp & Black Powder	Flare Assembly Line	11	13
Edgewood Arsenal	Aberdeen, MD	US 05/25/45	LAP	Igniters, M13	Air Tool	12	50
Terminal Island, Dock 223	San Pedro, CA	US 10/21/44	Industrial	Toluene	Two LSM's	12	16
Tinian	Mariana Islands	US 03/07/45	Storage Ops	Mines	Trucks	12	7
Rochester Fireworks Plant	Rochester, NY	US 11/06/42	Mfg	Signals, MKII, Red Star	Operating Building	12	11
Iowa Ordnance Plant	Burlington, IA	US 12/12/41	LAP	Mortar, 81mm	Melt Pour	13	53
Triumph Explosives Co	Elkton, MD	US 05/04/43	Mfg	Tracer Mix	Stokes Granulator	15	64
Eglin AFB	Pensacola, FL	US 07/12/43	Training	Demolition Blocks	Tree Stumps	17	50
Lighter at Sea	Boston Harbor, MA	US 05/13/44	Disposal	Ammunition	Lighter, 132 Foot	17	0
Iowa Ordnance Plant	Burlington, IA	US 03/04/42	LAP	Bombs, 500lbs GP	Melt Pour	22	84
NAS Norfolk	Norfolk, VA	US 09/17/43	Trans	Depth Bombs, AN-Mk47	Airfield Taxiway	27	399
Elwood Ordnance Plant	Joliet, IL	US 06/05/42	LAP	Mines, AT	Railcars	49	67
Pearl Harbor	Pearl Harbor, HI	US 05/21/44	Loading Barge	Ammunition	6 LST's & 3 LCT's	127	380

World War II Explosions
High Injury & Death Toll

Installation	Location	Date	Type	Items	Operation	Dead	Injured
USS Serpens	Guadalcanal	US 01/29/45	Loading Ship	Bombs	Ship	194	15
NAD Port Chicago	Concord, CA	US 07/17/44	Loading Ship	Ammunition	USS E A Bryan	325	392
*** Total ***						966	1790