

BREAKDOWN OF OSHA RECORDABLES* BY TYPE OF INJURY

FINGER/ARM	12
CAUSTIC BURNS	11
ANKLE SPRAINS	7
RIB AND TORSO INJURIES	6
CHLORINE INHALATION	1
EYE ABRASION	1
HEAT EXHAUSTION	<u>1</u>
	39

*COVERS 1979 - 1982 PERIOD

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OSHA RECORDABLE INJURIES

YEAR	TOTAL DIVISION	C/A	BRINE PROD.	CAUSTIC	CL ₂	CELL SERVICE	CA II
1982	57	9	1	3	3	-	2
1981	75	10	0	4	2	-	4
1980	80	11	0	2	3	1	5
1979	97	9	0	3	3	1	2
1978	94	22	0	4	8	1	9
1977	99	16	1	3	4	1	7

C/A OSHA Recordable Injuries as % of Division = 15.78% (14.75% if less 1978 & 1979)

C/A OSHA Recordable Injuries as % of Division:

1982	15.78%
1981	13.33%
1980	13.75%
1979	9.27%
1978	23.40%
1977	16.16%

Using Division 1980 as Basis:

1981	6.3%	Reduction from 1980 in OSHA Recordables
1982	24%	Reduction from 1981 in OSHA Recordables

From 1980 to 1982:

Division saw a 29% reduction in OSHA Recordables
C/A Group saw a 18% reduction in OSHA Recordables

From 1981 to 1982

Division saw a 24% decrease in OSHA Recordables
C/A saw a 10% decrease in OSHA Recordables

Based on Division Statistics:

	OSHA RECORDABLES THEO. INJURIES	ACT. INJURIES
If 1980 is Base	7.84	9
If 1981 is Base	7.6	9

INJURIES - OSHA RECORDABLES

OSHA RECORDABLES C/A GROUP (1979 - 1982)

TIME ON JOB

14
14
7
0
4
0
39

0 Mos. - 6 Mos.
6 Mos. - 2 Yrs.
3 Yrs. - 5 Yrs.
6 Yrs. - 10 Yrs.
11 Yrs. - 20 Yrs.
21 Yrs. - 30 Yrs.

TIME AT DOW

7
13
8
0
9
2
39

OSHA RECORDABLES BASED ON TIME IN CLASSIFICATION

77%	Those	0 - 2+ Yrs.
13%	Those	3 - 5 Yrs.
10%	Those	6 - 30 Yrs.

OSHA RECORDABLES BASED ON TIME AT DOW

51%	Those	0 - 2 Yrs.
21%	Those	2 - 5 Yrs.
28%	Those	6 - 30 Yrs.

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 - 1. Evaporation
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H. Caustic Finishing

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J. Hydrogen Collection

1. Motors and Compressors

SECTION I - HEADLINES :

I. A. Power Generation and Utilities

1. Turbines and Generators

- a. Gas turbine trip resulted in chlorine release.
- b. Employee burned by condensate.

2. Boilers and Heat Recovery Units

- a. Fingers caught between lid and mud drum.

3. Air Compressors

- a. Fingers caught between belts and sheave.
- b. Reciprocating compressor threw counterweight.
- c. A compressor discharge line caught on fire when some diesel got into the line.
- d. A handcrank struck an operator on the elbow when he failed to get clear of the motor.

4. Steam and Condensate

- a. Man burned with condensate when conductivity probe forced from line.
- b. Earth collapses and man's foot and leg burned by condensate.
- c. Repairing condensate leak man sprayed with hot caustic when valve accidentally opened.

B. Brine Treating and Brine Production

1. Miscellaneous

- a. Pickup truck struck from rear resulting in a severe neck strain.
- b. Mowing grass - tree fell across tractor.
- c. Employee slipped from lines and fell.
- d. An operator pulled a nail off his finger when his hand got caught between the pulley/cable.

2. Pressure Releases from Wells

- a. Operator receives a severe fractured elbow when a pipe at high pressure strikes him.

C. Chlorine Cell Operation

1. D.C. Power (Transformers and Rectifiers)

- a. Man fell into high voltage from transformer.

- b. Man fell from platform after receiving electrical shock.
- c. Electrical shock lancing anode compartment.
- d. Man fell after electrical shock.
- e. Electrical shock from contacting steel support.
- f. Electrical shock with air rod.
- g. Electrical "tingle" between buses.
- h. Electrical arc taking cell voltages. ~~XXXXXX~~
- i. Regulating transformer ruptured from three-phase fault.
- j. Possible electrical shock at buses.
- k. Cathode terminal connections melted.
- l. Switching error left end of series energized.
- m. Tool shorted across bus.
- n. Closed wrong switch caused flash resulting in burns.
- o. Rectifier improperly tagged.
- p. Man fell after electrical flash fracturing ankle.
- q. Burns occurred when man closed wrong switch.
- r. Closing wrong switch resulted in flash burns.
- s. Rectifier explosion and fire.
- t. Rectifier trip resulted in chlorine release.
- u. Lightning strikes a D.C. bus on the chlorine cells causing severe damage.
- v. A water leak inside a rectifier causes severe damage.
- w. A rectifier was damaged when several diodes ruptured simultaneously.

C. Chlorine Cell Operation

2. Chlorine-Hydrogen

- a. Cell cathode failure caused explosion.
- b. Explosion after a patch job.
- c. Reaction resulting from putty falling.
- d. Low brine level from brine filter salting up.
- e. Same as above.
- f. Explosion resulting from hydrogen analyzer problems.
- g. Explosion resulting from low head.
- h. Explosion resulting from hole in cell body.
- i. Explosion resulting from low head.
- j. Explosion resulting from low head.
- k. Explosion resulting from communication error.
- l. Cell holes resulted in low level and an explosion.

3. Hydrogen

- a. Explosion in series being dismantled.
- b. Ignition under roof of cell building.
- c. Explosion in cooling water trench.
- d. Several fires and a hydrogen head explosion.
- e. Large quantity of air into Plant B hydrogen system.
- f. Ignition in out-of-service water line.
- g. Explosion under series after erection.
- h. Explosive mixture where work being performed.

- i. Explosion in hydrogen header from overhead burning
- j. Air into Plant B hydrogen system.
- k. Ignition under series at cathode end.
- l. Terminal insulator failure apparently led to fire.
- m. Arcing and missing backstopper resulted in fire.
- n. Fire when cleaning hydrogen outlets.
- o. Torch ignited hydrogen at cathode.
- p. Man fell when installing hydrogen boot and broke elbow.
- q. A sewer exploded when the H₂ vent became plugged with brine.
- r. Multiple explosions occurred when high H₂ levels were generated by startup with cold brine and poor salt precipitation.

4. Cell Effluent

- a. Man stepped in trench; received leg burns.
- b. Employee fell in trench sustaining cuts and burns.
- c. Employee bruised from fall at truck.
- d. An operator had caustic and H₂ blown into his face when removing cell putty from an H₂ outlet.

5. Materials of Construction

- a. Shoulder fracture when wooden walkway collapsed.
- b. Man fell through wooden walkway breaking bone.

6. Miscellaneous

- a. Chemical goggles slipped from hand striking his eye.
- b. Missing step on ladder resulted in fall.
- c. Guard slipped and caught fingers.
- d. Cylinder catches on fire and man burned.
- e. Man slips and falls injuring shin.
- f. An operator opened a valve to a cell that was red tagged.
- g. An open bottle of a chemical was left on the cell and it caused a fire when spilled.

D. Chlorine Collection, Cooling, Drying and Compression

1. Intercoolers

- a. Intercooler chlorine-copper reaction resulted in chlorine release.

2. Sulfuric Acid

- a. Man burned from sulfuric acid in air hose.
- b. Expansion joint failure at pump discharge.
- c. Chlorine inhalation at drying towers.
- d. Sulfuric acid splattering on man from overflow line.
- e. Pressured acid released through hole in line.
- f. Hose slips from connection at sulfuric acid truck.

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3. Hydrochloric Acid

- a. Dome blown off hydrochloric acid truck.
- b. A graphite block in a HCl absorber was damaged when an explosion occurred in the HCl burner.
- c. An acid gathering tank in the HCl burner area had its lid pop off when liquid chlorine entered the burner.

4. Compressors

- a. Compressor thrust bearing failed.
- b. Iron-chlorine reaction results in chlorine release.
- c. Positive displacement-compressor valve failure.
- d. Broken crankshaft on positive displacement compressor.
- e. Metallized crankshaft fatigue failure.
- f. Positive displacement compressor crankshaft failure.
- g. Galvanized crankshaft failure.
- h. Positive displacement compressor sheave failure.
- i. Fire in crankcase of P.D. compressor.
- j. Chlorine and iron reaction in high stage P.D. compressor results in chlorine release.
- k. Freon compressor high temperature causes reaction.
- l. A compressor failure caused a 500 ppm release of chlorine for several minutes.
- m. A wet chlorine compressor was destroyed by a dry chlorine and titanium reactor.

E. Chlorine Liquefaction, Loading and Distribution

1. Chlorine-Iron

- a. A positive displacement compressor failed.
- b. A centrifugal compressor failed.
- c. A centrifugal compressor failed.
- d. A centrifugal compressor failed.
- e. A centrifugal chlorine compressor failed.
- f. Lawrence pump bearing failure.
- g. A sea water exchanger ignited.
- h. Steel packing in a chlorine recovery column ignited during startup.
- i. A major chlorine release occurred when a liquid chlorine pump erupted causing surrounding pipe damage.
- j. A chlorine-hydrogen fire occurred in a chlorine absorber when chlorine gas contacted with H_2 from packing.
- k. A liquid chlorine tank caught on fire when a hot bearing on a pump burned a hole in the tank.

2. Lines, Valves, Exchangers

- a. Liquid chlorine line leak from hydrochloric acid corrosion.
- b. Exposed underground line leaks chlorine.
- c. Liquid chlorine line leak from external corrosion.
- d. Liquid chlorine line leak at support points.

- e. Chlorine leak from corroded intercooler nipple.
- f. Chlorine leak from sniff line.
- g. Chlorine leak from intercooler.
- h. Chlorine leak at tank car loading results in inhalation.
- i. Valve bonnet bolts removed permitting liquid chlorine to escape.
- j. Chlorine release when reboiler tube bundle removed.
- k. Chlorine valve "exploded" from reaction with grease.
- l. Liquid chlorine valves tagged open by mistake.
- m. Ball valve aluminum operator broken.
- n. Chlorine pressure gauge removal resulted in inhalation.
- o. Chlorine leaks from defective hose.
- p. A taffy pot exploded due to a runaway exothermic reaction.
- q. A reboiler exploded due to a runaway exothermic reactor.
- r. A tail gas line split open and burned due to a high hydrogen concentration.
- s. A chlorine-hydrogen fire occurred in a line that had been improperly prepared for service.
- t. A air-hydrogen explosion occurred in a chlorine tail gas scrubber when the chlorine was scrubbed out a H_2 -air mixture remained.
- u. A chlorine-iron fire occurred when a solution of $FeCl_3$ corroded a line fast enough to cause a fire.

3. Emergency Block Valve Failures

- a. Nitrogen leak activates emergency block valve.
- b. Aluminum-chlorine reaction results in liquid chlorine release.
- c. Blown fuses activate emergency block valve.
- d. Chlorine evaporator overpressure causes gas release.

4. Laboratory

- a. Chlorine-caustic reaction results in burn to foot.
- b. Chlorine-carbon bisulfide explosion.
- c. An operator burned her eyes with caustic after running some laboratory samples.
- d. A plant operator had a tantalum cylinder explode due to improper sampling procedure.

5. Loading and Unloading

- a. Truck driver overcome by sodium hydrosulfide.
- b. Changing valves results in a chlorine release.
- c. A loaded chlorine tank car nearly collided with a train engine due to lack of communication.

F. Chlorine Cell Manufacture and Maintenance

1. Fork Lift Trucks

- a. Operator struck by fork lift truck.
- b. Fork lift truck partially fell from ramp.
- c. Fork lift truck started and moved with no driver present.

- d. Load on fork lift truck strikes man.
- e. Fork lift truck smashes starter fluid can.
- f. Caustic splashed forehead of fork truck driver.
- g. Employee hand caught between tubs.
- h. Fork truck driven into stream line support.

2. Cranes, Hoists, and Associated Devices

- a. Chains pinch employee's fingers.
- b. Hand caught between cell frame and lifting device.
- c. Man's hand caught by inner cell casting form.
- d. Bouncing cell catches man's thumb.
- e. Cathode slipped slicing finger.
- f. Cathode swings striking crane operator's foot.
- g. Man's hands mashed under timber.
- h. Crane pendant control shorted and moved by itself.
- i. Lug slipped off knob resulting in broken cell.
- j. Crane lever fails to stop crane.
- k. Crane rail breaks.
- l. Shorted pendant moves crane.
- m. Wheels drop off bridge rail.
- n. Cab crane runs off bridge.
- o. Crane cab falls to floor.
- p. Cable broke when lifting cell.
- q. Yoke and chain wheel fell to floor.
- r. Cable snaps when packing up cells.
- s. Motor falls bouncing through wall.
- t. Yoke fell and hit man on head and shoulder.
- u. Man caught between cell bodies.
- v. Cable breaks dropping cathode into draw tank.
- w. Outer cell body form falls.
- x. Hand caught between cell frame and lifting device.
- y. Crane began moving by itself.
- z. Crane cable breaks while changing position of a cell.
- aa. Crane control does not stop travel.
- bb. Crane rail breaks at welded joint.

3. Cathode Drawing, Drying and Cleaning

- a. Liquid entering top of boots results in chemical burns.
- b. Man working without protective apron.
- c. Electrician's hand got caught in moving equipment.
- d. Damaged boot results in acid burn.
- e. Man's heel fractured after slip from ladder.
- f. Finger caught between cathode jig frame and I-beam.
- g. Unplugging pressured line causes loss of vision in eye.
- h. Handle of cathode lifter struck man's cheek.
- i. Cathode falls from lifter onto employee's foot.
- j. Cathode fell to floor.
- k. Pendant shorted and crane moved down rail.

4. Series Erection and Dismantlement

- a. Man stepped backward from cell and fell.
- b. Latch box on squeezer broke.
- c. Iron timber clamp fell on man's foot.
- d. Foreign body in eye.
- e. Fingers caught between squeezer and hook.
- f. Employee stepped on back up; it slipped off cover hitting his leg.
- g. Man's fingers were caught between cover and the floor.
- h. Failure of lugs on cell squeezer.
- i. Dummy fell backward off skid.
- j. Chain link breaks.
- k. Cell knob failure.
- l. Employee shocked.
- m. Cell knob failures.

5. Cell and Cover Manufacture

- a. Employee fell and cover partition landed on foot.
- b. Man fell from sand hopper car shattering wrist.
- c. Chemicals in eyes.
- d. Finger pinned by lining pin.
- e. Cutting blade rips shirt off employee.
- f. Angle iron strikes man.
- g. Chemicals ignite and burn employee.
- h. Fingers caught in gears of saw.
- i. Man mashed finger while opening tail gate of truck.
- j. Plate slips and struck employee's finger.
- k. Piece of bearing flew out and lodged in man's forearm.
- l. Electric truck rolled on man's foot.
- m. Plates fall through rack striking man on shoulder.
- n. Plate falls out of cell and cuts man's lip.
- o. Abrasive disc broke and struck employee.
- p. Grinder kicked back striking let.
- q. Falling box of copper hits employee on foot.
- r. Graphite board falls on man's foot.
- s. Improper tool used cutting band.
- t. Glancing hammer fractures finger.
- u. Form slips off cell and employee's hand gets caught between form and concrete.
- v. Lug slipped off cell knob.
- w. Valve breaks and employee sprayed with chemicals.

6. Miscellaneous

- a. Window drops on employee's finger causing finger to be amputated.
- b. Chisel flips up fracturing employee's cheek bone.
- c. Glove caught by drill bit and injures employee's arm.
- d. A-frame collapses on floor sweeper.
- e. Pivot arm falls on employee's foot.
- f. Saw amputates finger.

G. Caustic Operations

1. Evaporation

- a. First effect evaporator ruptured.
- b. Pressure blew out stopper and caustic hit man in face.
- c. Man sprayed with hot caustic when removing circulating pump.
- d. Caustic sprays through open valve striking man.
- e. Employee stepped into open trench burning ankle and foot.
- f. First effect heat exchanger ruptured on steam side.
- g. Expansion joint without stay bolts.
- h. Level control failed and caustic sprayed to atmosphere.
- i. Hot caustic spilled out of evaporator when opened.
- j. Caustic vented from cyclone.
- k. Caustic sprayed from drain valve and employee burned.
- l. Caustic splashing at cyclone.
- m. Pump discharge line cracks and 50% caustic sprayed the area.
- n. An operator broke his finger when he got the finger caught between the wrench and spool piece.
- o. A gasket blew caustic and ammonia 20 feet into the air.
- p. A pipe nipple broke off a caustic feed line dumping several thousand pounds of caustic.
- q. An expansion joint ruptured allowing 145 gpm of NaOH to contaminate a seawater flume.
- r. An operator incorrectly blocked in valves to wash a caustic feed line and was sprayed with hot caustic.

2. Salt Removal and Filtration

- a. Employee burned with caustic when removing hose.
- b. Pump coupling broke and knocked guard off base.
- c. Steam hose ruptured spraying hot condensate on man's leg.
- d. Hot condensate strikes employee's leg.
- e. Finger caught between pipe and hand rail.
- f. Coupling fails and caustic splashed on man causing burns.
- g. Machine runs backwards.
- h. Caustic sprays in employee's eyes.

3. Iron Cells

- a. Acid was being added to iron cell and material was sprayed over everything.
- b. Pyrophoric iron flashes in iron cell.

4. Low Salt Plant

- a. Maintenance employee fell over drain line and sustained fracture to his leg.
- b. Nozzle separates at weld and caustic-ammonia mixture sprayed into air.
- c. Depressuring line and ammonia suddenly blew out of hose.
- d. Ammonia released during shutdown.
- e. Employee sprayed when walking on walkway.

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5. Loading and Unloading

- a. Unloading hose blown out of storage tank and spraying caustic.
- b. Men sprayed with cell effluent as loading line removed.
- c. Hot water burns employee washing caustic from hand.
- d. Caustic splashed from storage tank and got behind man's chemical goggles.
- e. Valve wheel and chain operator fell striking man on head.
- f. Caustic spilled from truck.
- g. Expansion joint ruptures and area sprayed with caustic.
- h. Chock slips and car rolls.
- i. Pressured line slips and sprays employee.
- j. Hose blew off spraying caustic.
- k. Caustic blows out of dip pipe.

6. Miscellaneous

- a. "Water hammer" damages line.
- b. Operator steps into small hole and got caustic in shoe.
- c. Ladder fell off rack and knocked man down.
- d. Aluminum wrench breaks.
- e. Bonnet blew off valve spraying men with cell effluent.
- f. Operator violates "red tag" rule.
- g. Portion of line pressured by mistake and contractors splattered with cell effluent from water line.
- h. Man caught fingers between fan and housing.
- i. Employee's sleeve caught on wire holding socket on air motor shaft.
- j. Employee loosened valve bonnet and sprayed with caustic.

H. Caustic Finishing

1. Evaporation

- a. Employee sprayed with caustic from top of level control tank.
- b. Hole in hot water hose results in burns to foot.
- c. Hot caustic sprays out between flange on dust collection system.
- d. Employee putting on chemical goggles when material blown into eye.
- e. An operator was sprayed with hot caustic when a centrifuge tripped out.
- f. A flange on top of a tank blew out hot caustic on people below.
- g. An explosion occurred in a reaction of carbon steel and hot caustic on a tank.

2. Loading and Storage

- a. Hose lining failed and caustic sprayed out between flanges.
- b. Steaming lines and blew onto employee.
- c. Thawing line and end of loading arm swung around knocking man unconscious.
- d. Filling drum with spout above drum and caustic splashed on an employee.
- e. Finger broken when caught between capper and lip on drum.

- f. Drum fell from conveyor and seam burst spraying molten caustic over area.
- g. Man slipped and brushed forearm across hot drum.
- h. When inserting lid, caustic popped onto man's arm, neck, and head.
- i. Caustic came out a small slot in protective shield and burned man's hand.
- j. Loading spout hung on drip pan and caustic splattered on employee's thigh.
- k. Water added to caustic drum and caustic erupted from drum onto man.
- l. Employee moving drum with 2"x4", drum fell splattering him on arms and chest.
- m. Drum torn by ram and molten caustic ran out striking his stomach and hands.
- n. Ram retracts and pinned man's arm against housing.
- o. Employee was placing lid on a solid caustic drum when he was splashed with hot molten caustic.
- p. Water was introduced into a caustic tank and steam generated pressured tank.
- q. Nitrogen pressure on hopper trailer blew camlock cap into employee's face.
- r. Valve handle and chain assembly fell striking man on head and stomach.
- s. A deflector head punctured a drum, spraying molten caustic on operator.
- t. A drum filled with molten caustic overflowed and splashed on a man.
- u. Wooden pallets ignited by hot caustic drums.
- v. A tank car released caustic/water through a vent due to the dilution of 73% caustic with water.
- w. A tank car that was to be loaded with caustic was found to have some acid in the bottom.
- x. An operator was overcome by breathing NH_3 after he began to load caustic in a tank car that had 70 gallons of an ammonia-based product.
- y. Operators blew a tank of 50% hot caustic when trying to unplug a 50% line with condensate.
- z. A major NH_3 spill occurred when a tank car that was pumping out NH_3 encountered mechanical difficulties.

3. Miscellaneous

- a. Employee fell as a result of a loose step.
- b. The yoke and chain wheel for transverse movement fell to the floor.
- c. Valve yoke broke and assembly fell.
- d. Employee attempted to use a crane that was attached to a line.
- e. Fan wheel falls to floor when shaft breaks.
- f. Pry bar slips and man's finger was pinched and broken.
- g. Foot flipped into conveyor and he fell.

I. Maintenance

1. Falls

- a. Employee stumbled and pushed wooden shelf on another employee.

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- b. Inspector falls from a chain ladder.

2. Materials Handling

- a. Employee's finger caught between shaft and hard toe of his boot.
- b. Cherry picker tilts against highline pole.
- c. Fingers smashed between condor lift and crane.
- d. Cranes almost decapitate man.
- e. As a walkway was being removed from its support columns, the support column tilted over.

3. Electrical

- a. Broken switch does not open circuit in open position.
- b. When attempting to pull down main disconnect breaker arm, an explosion occurred.
- c. Power on electrical leads to control cable which was being worked on.
- d. Bus not labelled correctly.
- e. 440 volt insulated motor lead flashes and burns hand.
- f. Handle for disconnect turns without opening disconnect.
- g. End bell blown off crane motor.
- h. An electrician was killed when his sprayer came in contact with a switch, creating a short circuit.

4. Burning and Welding

- a. Delayed roof fire after torch used to thaw lines.
- b. Welding machine not grounded properly.
- c. Acetylene bottle catches fire.
- d. Hot tap done on wrong line.
- e. Valve stem in a tank cut and ammonia fumes fill tank.

5. Miscellaneous

- a. Finger caught between belts and sheave.
- b. Employee wearing safety glasses got flake of caustic in his eye.
- c. Pipe pinwheeled and struck man above left eye.
- d. Pipefitter tightened plug on leading safety valve and it blew out.
- e. Hot water in eye bath had steam tracing on it.
- f. Hydrogen blower belts caught on fire.
- g. Finger mashed between wrench and pump housing.
- h. An operator in chlorine suffered heat exhaustion when getting overheated in the chlorine loading area.
- i. An operator had a wrench handle fall 20' to strike him on the forehead.
- j. An operator jumped out of a piperack and suffered a minor fracture to the pelvic area.
- k. Two jobs inside a vessel did not realize other was taking place.
- l. A gasket blew out a salt slurry solution causing chemical burns to both eyes.
- m. An operator fell 6' when he used a wooden handrail to use as a prop to gain leverage on a valve.

n. A piece of equipment at a sump was started when it was red-tagged.

J. Hydrogen Collection

1. Motors and Compressors

- a. A motor was severely damaged due to the lack of knowledge about the motor.
- b. A hydrogen-air explosion occurred when a compressor lost positive pressure.
- c. Two lower power explosions took place during startup due to faulty instrumentation.