

EXPLOSION IN DETONATOR ASSEMBLY HOUSE

PAPER PRESENTED BY

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BRIEF HISTORY OF THE COMPANY

- THE ACCIDENT HAPPENED IN A DETONATOR ASSEMBLY HOUSE OF ECONOMIC EXPLOSIVES LTD.
- THIS COMPANY IS A 100% SUBSIDIARY OF SOLAR INDUSTRIES INDIA LTD. AND STARTED PRODUCTION IN 1998.
- ECONOMIC EXPLOSIVES LTD. MANUFACTURES THE FULL RANGE OF DETONATORS

SUMMARY OF THE INCIDENT

- DATE & TIME OF INCIDENT :
24 March 2013 at 15.30 hrs.
- LOCATION OF INCIDENT :
In the Filled Shell Store of Detonator Assembly House no. D11
- NUMBER OF PERSONS FATALLY INJURED : 2
- NUMBER OF PERSONS INJURED : 2
- EXTENSIVE DAMAGE TO BUILDING BUT NO EFFECT ON SURROUNDING BUILDINGS.

PROCESS OUTLINE OF OPERATIONS IN FILLED SHELL ROOM

- BRING A CASE OF FILLED SHELL CONTAINING A MAXIMUM OF 4000 FROM THE MAGAZINE TO FILLED SHELL ROOM.
- TAKE OUT A CARTON WITH 100 SHELLS AND PLACE ON TABLE
- REMOVE THE ADHESIVE TAPE ATTACHING THE CARTON COVER TO IT'S BASE
- HOLD THE CARTON IN ONE HAND , VISUALLY INSPECT THE SHELLS IN THE CARTON,NOTE DOWN THE BATCH DETAILS.
- REPLACE THE CARTON COVER, WITHOUT THE ADHESIVE TAPE,INSIDE A WOODEN CARRYING BOX PLACED ON THE TABLE.
- WHEN 4 SUCH CARTONS HAVE BEEN PLACED IN THE CARRYING BOX,IT IS MANUALLY CARRIED BY THE SAME OPERATOR TO THE DETONATOR ASSEMBLY HALL FOR DISTRIBUTION TO THE CRIMPING OPERATORS.

DESCRIPTION AND IMPACT OF INCIDENT

- ON 24.03.2013 SENIOR MANAGERS WERE IN A MEETING IN THE CONFERENCE HALL
- AROUND 15.10 HRS.THE MANAGERS HEARD THE SOUND OF AN EXPLOSION OF LOW INTENSITY FOLLOWED BY ANOTHER ONE OF HIGHER INTENSITY.
- MANAGERS RUSHED OUT AND SAW INTENSE SMOKE COMING OUT FROM D11 BUILDING
- ONE OPERATOR WAS THROWN OUT ABOUT 20 MTS.FROM THE BUILDING WITH SERIOUS INJURIES .
- TWO OTHER OPERATORS HAD BURN INJURIES .
- ALL THESE 3 OPERATORS WERE IMMEDIATELY SHIFTED BY AMBULANCE TO HOSPITAL .THE OPERATOR WITH SERIOUS INJURIES DIED ON THE WAY TO HOSPITAL.
- LATER THE BODY OF THE OPERATOR WORKING IN THE FILLED SHELL ROOM WAS RECOVERED FROM THE ROOM.

INVESTIGATIONS CARRIED OUT

- **A. EXAMINATION OF SITE OF INCIDENT :**
- CONCRETE ROOF OF THE FILLED SHELL ROOM WAS BLOWN OFF
- ALL WOODEN RACKS AND TABLE HAD BURNT TO ASHES
- SEVERE STRUCTURAL DAMAGE OCCURRED TO THREE OTHER NEARBY ROOMS. THERE WAS ONLY MINOR DAMAGE TO THE CRIMPING HALL
- A NUMBER OF EXPLODED AND UNEXPLODED DETONATORS WERE FOUND
- TWO CRATERS OF ABOUT 2FT. X 1FT. WERE SEEN ON THE FLOOR OF THE FILLED SHELL ROOM
- NO DETONATORS IN THE CRIMPING HALL WERE AFFECTED
- THE CHARRED BUT INTACT BODY OF THE OPERATOR WAS SEEN LYING ON THE FLOOR WITH HIS LEGS FACING THE DOOR OF THE ROOM.

- **B. INFORMATION GATHERED :**
- THE FILLED SHELL ROOM HAD A LICENCED CAPACITY OF 30000 DETONATORS
- AT THE TIME OF THE INCIDENT THERE WERE 26916 DETONATORS IN THE ROOM COMPRISING OF DIFFERENT TYPES OF DELAYS
- ON 24.03.13 ,SECOND SHIFT OPERATION STARTED AS USUAL AT 14.30 HRS.
- ONE PACKED CASE CONTAINING 1500NOS.AND ANOTHER WITH 600 NOS. OF DETONATORS WERE KEPT ON THE FLOOR WHERE THE CRATERS WERE FOUND.
- ANOTHER PARTIALLY FILLED CASE (FROM WHICH THE OPERATOR WAS REMOVING THE CARTONS), WAS PLACED NEAR THE BASE OF THE TABLE ON THE LEFT SIDE OF THE OPERATOR WHO WAS SITTING ON A STOOL.
- THE REST OF THE DETONATORS WERE PLACED IN TRAYS KEPT ON RACKS PROVIDED ALONG THE WALLS.

LIKELY CAUSE OF THE INCIDENT

- **SABOTAGE** : RULED OUT DUE LACK OF EVIDENCE
- **HEAT/FIRE** : NO EVIDENCE TO SUPPORT
- **LIGHTNING STRIKE** : IT WAS A CLEAR SUNNY DAY
- **SPARK FROM ELECTRICAL SHORT CIRCUIT**: ONLY FLAME PROOF FITTINGS WERE PROVIDED
- **STATIC DISCHARGE** :OPERATOR WAS WEARING COTTON CLOTHING WORKING BAREFEET, TABLE TOP AND FLOORING HAD CONDUCTIVE RUBBER .HENCE IGNITION DUE TO STATIC DISCHARGE WAS RULED OUT
- **FRICTION** :SINCE THERE WAS NO HANDLING OF LOOSE DETONATORS ,HENCE ANY FRICTIONAL EVENT WAS RULED OUT

- **IMPACT : IGNITION DUE TO IMPACT WAS DEBATED IN DETAIL THREE SCENARIOS EMERGED :**

1. IMPACT DUE TO FALLING OF ANY OBJECT FROM A HEIGHT ON THE DETONATORS KEPT ON TABLE. THIS WAS RULED OUT AS THERE WAS NO HEAVY OBJECT OR ANY OTHER HEAVY FITTING PLACED OVER THE TABLE.

2. IMPACT OF DETONATORS FALLING ON A HARD SURFACE. SINCE THE FLOORING HAD A SOFT CONDUCTIVE RUBBER SHEET, IGNITION DUE TO FALLING OF DETONATORS BY ITSELF WAS RULED OUT.

3. THE THIRD POSSIBILITY WAS DEBATED IN DETAIL. IN THIS CASE WHILE LIFTING THE CARTON OF LONG DELAY FILLED SHELLS (WEIGHING AROUND 1.0 KGS), IT SLIPPED OUT OF THE HAND OF THE OPERATOR, LEAVING ONLY THE COVER IN HIS HAND.

AS A REACTION THE OPERATOR TRIED TO ARREST THE FALLING CARTON AND IN THE PROCESS DISLODGED THE WOODEN CARRYING BOX (WEIGHT 2.5KGS) KEPT ON THE LEFT HAND SIDE ON TOP OF THE TABLE.

- THE CARRYING BOX IMPACTED ON THE DETONATORS, WHICH HAD SPILLED OUT ON THE FLOOR FROM THE CARTON, RESULTING IN THE EXPLOSION.
- THE FALL HEIGHT FROM THE TOP OF THE TABLE OF THE CARRYING BOX WAS 1.0 MTS.
- SIMULATION TRIALS WERE CARRIED OUT USING DUMMY DETONATORS AND IT DID CONFIRM THAT THIS COULD BE THE MOST PROBABLE CAUSE OF THE EXPLOSION.
- THAT THE EXPLOSION HAD INITIATED AT THE GROUND LEVEL WAS GAUGED FROM THE FACT THAT -
 - a) THE BONES ON THE LEGS OF THE OPERATOR WERE SEVERELY CRUSHED
 - b) BODY OF THE OPERATOR WAS OBSERVED ON THE FLOOR WITH HIS LEGS POINTING TOWARDS THE ENTRANCE TO THE ROOM.
 - c) PRESENCE OF SOME CARTONS OF DELAY FILLED SHELLS IN A BOX (NEAR THE BASE OF TABLE) FROM WHICH THE OPERATOR WAS TAKING OUT CARTONS FOR INSPECTION.
- * THE INITIAL EXPLOSION TRANSMITTED TO THE OTHER FILLED SHELLS STORED ON THE RACKS IN THE ROOM LEADING TO A MAJOR EXPLOSION.

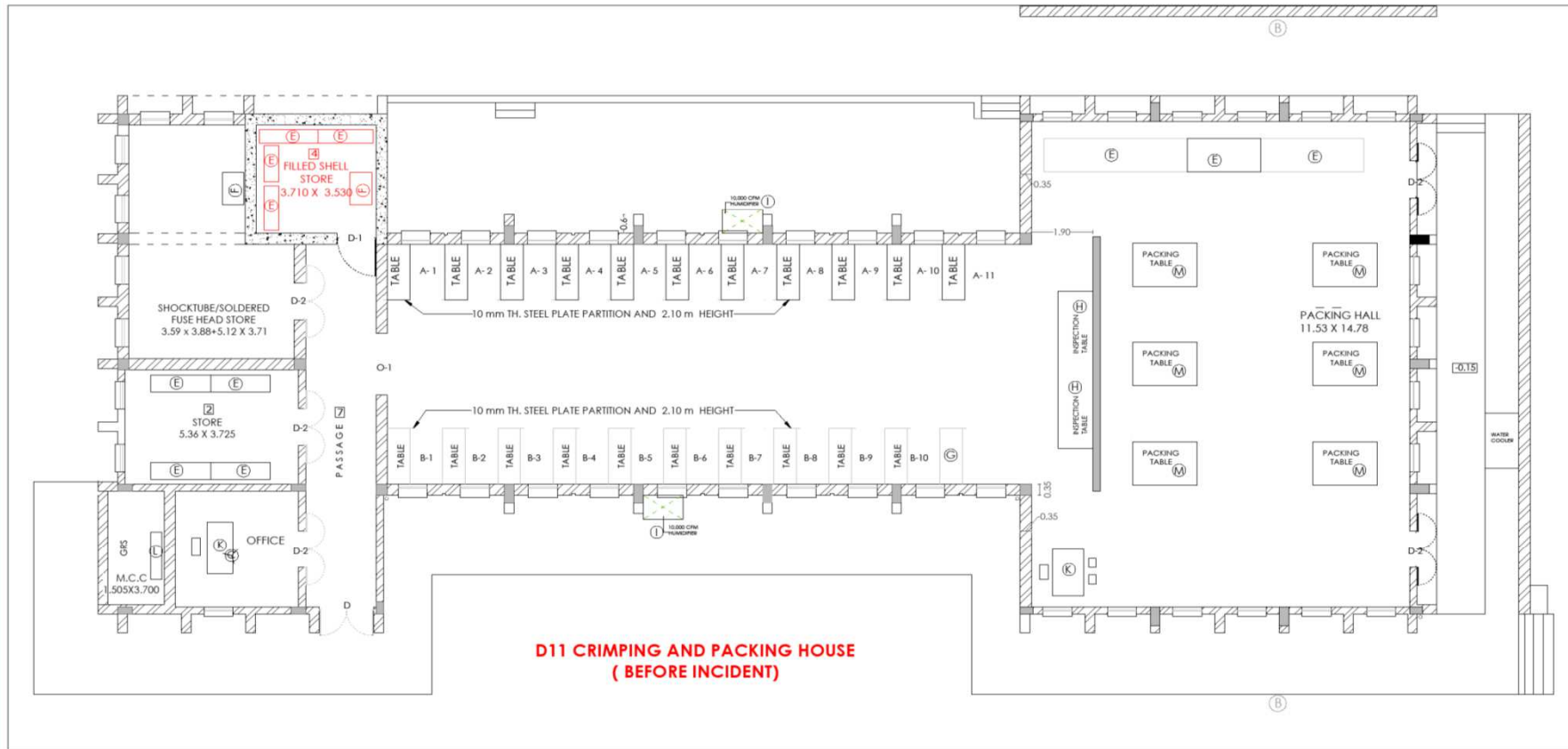
ACTIONS TO PREVENT RECURRANCE

- NO OPERATIONS SHOULD BE CARRIED OUT IN THE FILLED SHELL ROOM. IT SHOULD ONLY BE USED AS A ISSUE ROOM.
- REMOVAL OF GUM TAPE FROM CARTONS AND RECORDING OF BATCH DETAILS WOULD BE DONE IN A ADJACENT ROOM.
- REDUCE THE EXPLOSIVE LIMIT IN DIFFERENT SECTIONS OF THE CRIMPING BUILDING.
- FILLED SHELL STORE AND DISTRIBUTION ROOM SHOULD HAVE A WEAK WALL TO ACT AS A BLOW-OFF PANEL
- INSPECTION AND COUNTING OF CRIMPED DETONATORS TO BE SHIFTED FROM THE MAIN CRIMPING HALL TO THE PACKING HALL.

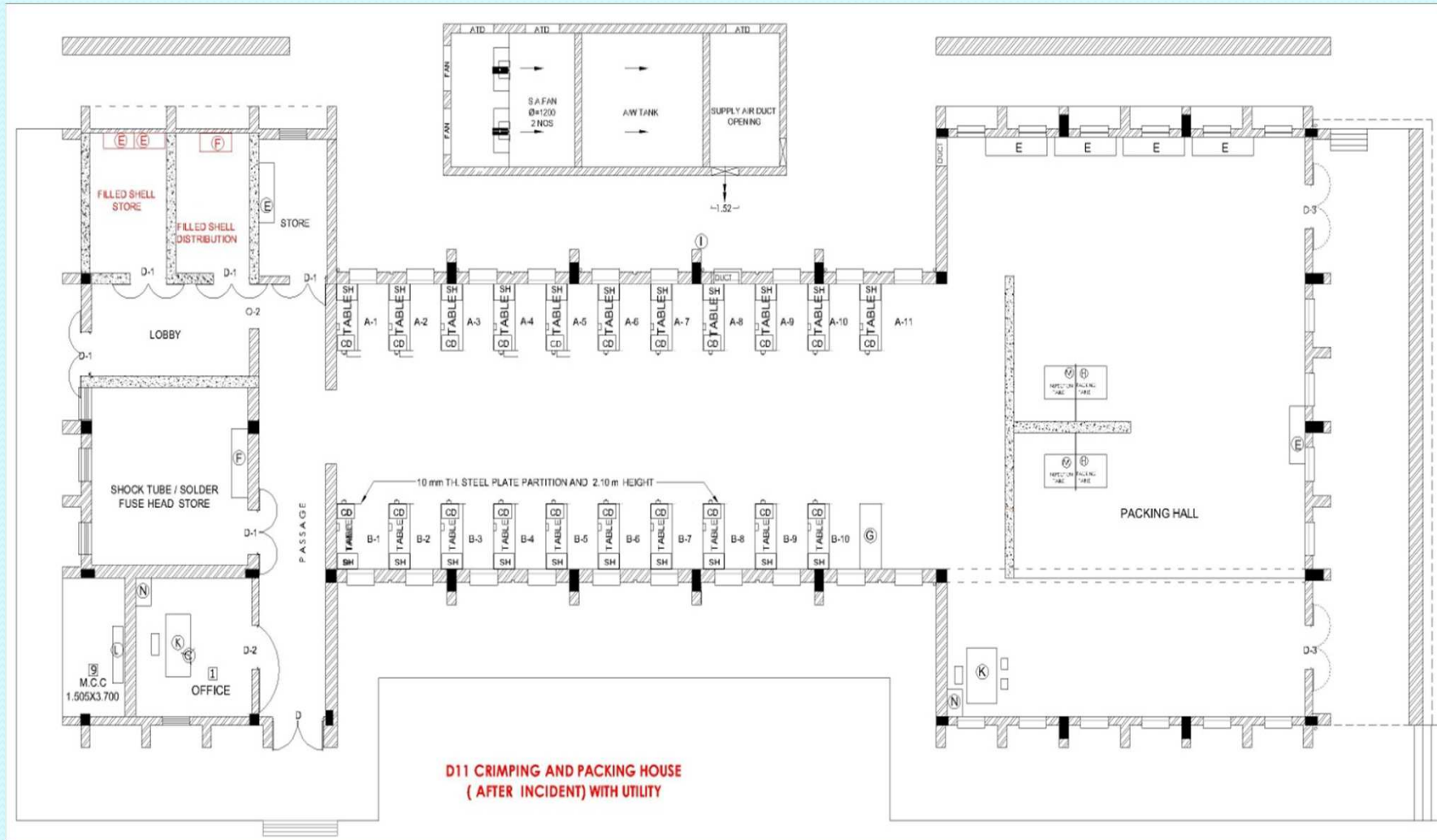
TAKE HOME MESSAGE

- EVERY HAZARDOUS OPERATION SHOULD BE ASSESSED FOR THE RISKS INVOLVED IN THE ACTIVITY
- INVENTORY OF EXPLOSIVES IN ANY OPERATION SHOULD BE KEPT AT BARE MINIMUM
- DESIGN OF BUILDINGS HAVE AN IMPORTANT BEARING IN REDUCING THE EFFECT IN THE EVENT OF AN EXPLOSION

LAYOUT OF BUILDING BEFORE EXPLOSION



LAYOUT OF BUILDING AFTER EXPLOSION





CRIMPING HALL
VIEW FROM FAR
SIDE



ROOM FROM WHERE
EXPLOSION INITIATED



VIEW OF CRIMPING
HOUSE



DOOR ENTRANCE TO
FILLED SHELL ROOM