

Tank Truck Explosion

Date of Incident: 99 10 27

Type of Incident: Double Fatality

SUMMARY

On 99 10 27, at approximately 18:30, an Operations Manager and a labourer were welding an overflow pipe on top of a tank truck that contained residual flammable materials. The tank truck exploded during the welding operation and both workers were fatally injured. The incident occurred at the main shop of an oilfield swabbing company located in Redcliff, Alberta.

The direct cause of the incident was the welding sparks ignited the residual flammable materials causing the tank to explode. The contributing factor of the incident was the explosive atmosphere in the tank was not tested prior to initiating the welding.

Workplace Health and Safety commenced an investigation the same day. The investigators issued a Client Contact Report to the employer requesting safe work procedures for welding activities on tank trucks. Workers were to be trained in the safe work procedures and an investigation report was requested. A laboratory sample of the residual flammable material was acquired from the tank truck and analyzed for composition. Witness statements were gathered; photographs and measurements were taken at the scene. The employer complied with all recommendations outlined in the Client Contact Report and submitted their investigation report on 99 11 15.

The employer voluntarily stopped work and developed specific safe work procedures for tank truck maintenance. These activities included emphasis on welding repairs. Workers were trained in the new safe work procedures. Tank trucks selected for welding repairs are to be tested for explosive atmospheres. They will be purged, if necessary, to ensure no fire or explosion hazard exists. The preventative measures implemented should prevent a recurrence of this type of incident.

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Section 1.0 FILE NUMBER

1.1 396890

Section 2.0 DATE AND TIME OF INCIDENT

2.1 99 10 27, 18:30.

Section 3.0 DATE AND TIME OF INVESTIGATION

3.1 99 10 27, 21:00.

Section 4.0 NAME OF INVESTIGATOR(S) (INTERNAL)

4.1 Roni Mann, Workplace Health and Safety Officer

4.2 Tom Samoila, Workplace Health and Safety Officer

Section 5.0 INCIDENT REPORTED BY

5.1 Alberta Municipal Affairs, Lethbridge

Section 6.0 DATE AND TIME INCIDENT WAS REPORTED

6.1 99 10 27, 21:00

Section 7.0 NAME AND ADDRESS OF PRINCIPAL STAKEHOLDER(S)

7.1 **Owner(s)**

7.1.1 A-1 Swab Ltd.
Box 70, Site 1, RR 6
Calgary, AB
T2M 4L5

7.2 **Prime Contractor**

7.2.1 N/A

7.3 **Employer**

7.3.1 A-1 Swab Ltd.
#9, 1001 Highway Avenue
Redcliff, AB
T0J 0P0

Section 8.0 DESCRIPTION OF PRINCIPAL OWNER(S) OR EMPLOYER(S)

8.1 A-1 Swab Ltd. is a gas well servicing company specializing in oilfield swabbing operations. The company operates two swabbing rigs and two tank trucks that haul oilfield wastewater from well sites in Southern Alberta.

Section 9.0 LOCATION OF INCIDENT

9.1 The incident occurred at Bay #9, 1001 Highway Avenue N.E., Redcliff, Alberta.

Section 10.0 EQUIPMENT AND MATERIAL INVOLVED

10.1 The maintenance shop measured 24 metres long x 7 metres wide x 5 metres high. The building and roof of the shop were damaged during the explosion (Refer Attachment A, Diagram; Attachment B, Photos #1 and #2).

10.2 The tank truck unit consisted of a 110-barrel capacity tank installed on a 1980 International Tandem truck chassis. The tank contained approximately 455 litres of flammable residual material (wastewater saturated with methane) at the time of explosion. The wastewater was collected from seven gas wells (Refer Attachment B, Photos # 1 and #3; Attachment C, Laboratory Analysis).

10.3 The overflow pipe was 4 metres long and 8.2 centimetres in diameter with a 90° elbow attached. This elbow was to be welded to the overflow opening on top of the tank. The evidence revealed that a welding arc had been struck on the overflow pipe elbow (Refer Attachment B, Photos #4, #5 and #6).

- 10.4 A Miller brand Millermatic 250X wire feed welder was used to weld the overflow pipe (Refer Attachment B, Photo #7).
- 10.5 A Gastec combustible gas meter, model #GP204, was present in the cab of the truck.

Section 11.0 NAMES OF OTHER INVESTIGATORS (EXTERNAL)

- 11.1 A-1 Swab Ltd.
- 11.2 Alberta Infrastructure, Dangerous Goods Control Branch
- 11.3 Alberta Municipal Affairs, Safety Services
- 11.4 R.C.M.P., Redcliff Detachment
- 11.5 Town of Redcliff, Safety Codes Office
- 11.6 Town of Redcliff, Fire Department

Section 12.0 NARRATIVE DESCRIPTION OF INCIDENT

- 12.1 On 99 10 27, a rig manager and swamper noticed the overflow pipe located on top of their tank truck was leaking. They phoned the A-1 Swab Ltd. shop and informed the Operations Manager about the need to replace the overflow pipe.
- 12.2 At approximately 17:30, the rig manager and swamper brought the tank truck to the A-1 Swab Ltd. shop. They parked the tank truck at the rear of the building. They discussed the leak in the overflow pipe with the Operations Manager and labourer. After the discussion, the rig manager and swamper left the shop.
- 12.3 At approximately 18:00, two co-workers observed the Operations Manager and labourer on top of the tank truck grinding on the new overflow pipe. The Operations Manager asked a co-worker in the shop to turn the tank truck around to facilitate the welding. The co-worker drove the tank truck to the requested location in the shop.

- 12.4 The Operations Manager and labourer returned to the top of the tank truck to commence the welding operation. At approximately 18:30, the Operations Manager started welding the overflow pipe. The welding spark ignited the residual flammable materials and exploded the tank.
- 12.5 Two co-workers in the front office heard the explosion and went to investigate. They noticed extensive damage to the building and tank truck. One worker called Emergency Medical Services while the other worker searched for the Operation Manager and labourer.
- 12.6 One worker found the Operations Manager and began to perform CPR until Emergency Medical Services arrived.
- 12.7 The other worker discovered the labourer situated on top of the tank truck. He turned the labourer onto his back and comforted him until Emergency Medical Services arrived.
- 12.8 Emergency Medical Services arrived at the site at approximately 18:41. The workers were transported to the Medicine Hat Regional Hospital where they were pronounced dead.

Section 13.0 CONCLUSIONS

- 13.1 The direct cause of the incident was the welding sparks ignited the residual flammable materials causing the tank to explode.
- 13.2 The contributing factor of the incident was the explosive atmosphere in the tank was not tested prior to initiating the welding. The employer provided a combustible gas meter that was located in the cab of the tank truck. The Operations Manager was trained on the use of the combustible meter and did not use it to determine if flammable materials were present in the tank truck.
- 13.3 The incident could have been prevented if the Operations Manager and labourer had gas tested and purged the tank prior to initiating the welding.

Section 14.0 FOLLOW-UP/ACTION TAKEN

14.1 Industry

- 14.1.1 The employer voluntarily stopped work and complied with all Client Contact Report recommendations.

- 14.1.2 The employer investigated the incident and prepared an investigation report that was reviewed by Workplace Health and Safety.
- 14.1.3 The employer developed safe work procedures for tank truck maintenance activities with emphasis on welding. All workers were immediately trained emphasizing that testing and purging of vessels will be completed to ensure work may be safely performed.
- 14.1.4 The workers were also trained in First Aid/CPR and WHMIS.
- 14.1.5 The employer had their Gastec combustible gas meter inspected and calibrated. The workers were trained in the use of the gas detection equipment.
- 14.2 **Alberta Human Resources & Employment**
- 14.2.1 Workplace Health and Safety issued a Client Contact Report on 99 10 30 to ensure the employer conducted an investigation and submitted the report for review. The completed investigation report was received on 99 11 15.
- 14.2.2 The employer was requested to submit safe work procedures for tank truck maintenance activities with emphasis on welding. The acceptable procedures were received on 99 11 15.
- 14.2.3 The employer was requested to provide training for workers on the new safe work procedures for tank truck maintenance. The training was completed prior to workers restarting work.
- 14.2.4 Measurements, witness statements and photographs were taken at the scene.
- 14.2.5 A sample of the wastewater was acquired from the tank for laboratory analysis.
- 14.3 **Additional Measures**
- 14.3.1 Alberta Infrastructure, Dangerous Goods Control Branch, is following up to see if hauling of wastewater in the oil field industry should be regulated.
- 14.3.2 Workplace Health and Safety, southern region have implemented a concentrated program to address fire and explosion hazards in the workplace.

Section 15.0 INJURY SEVERITY

15.1 Both workers received fatal injuries as a result of this incident.

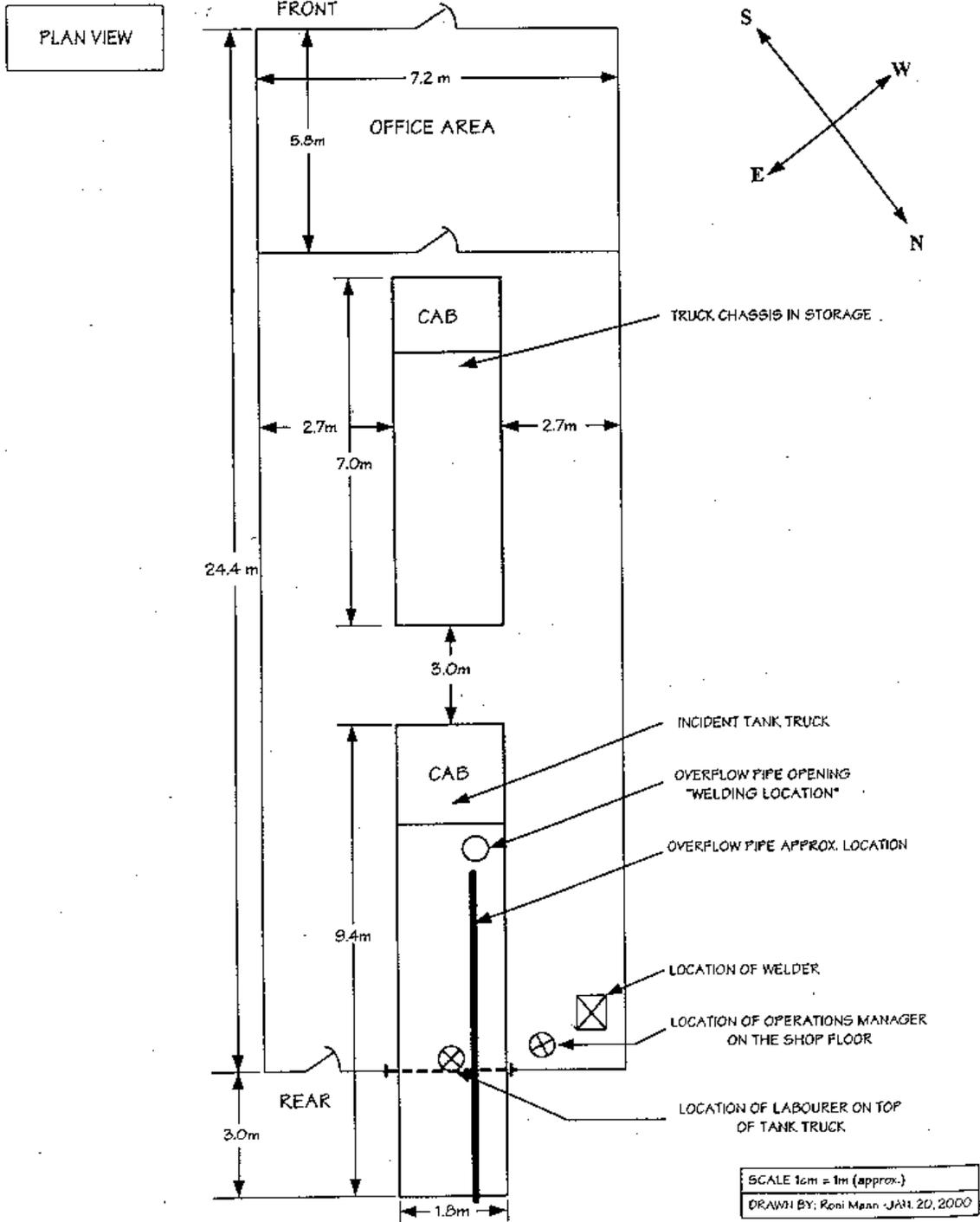
Section 16.0 SIGNATURES

[original signed]

Section 17.0 ATTACHMENTS

Attachment A	Diagram
Attachment B	Photographs
Attachment C	Laboratory Analysis

DIAGRAM OF A-1 SWAB LTD. MAIN SHOP INCIDENT SITE





Photograph #1 – Shows damaged building and location of the exploded tank truck extended past the shop door.



Photograph #2 – Shows damaged roof and cab of tank truck lodged in the ceiling.



Photograph #3 – Shows the damaged tank truck from the rear.



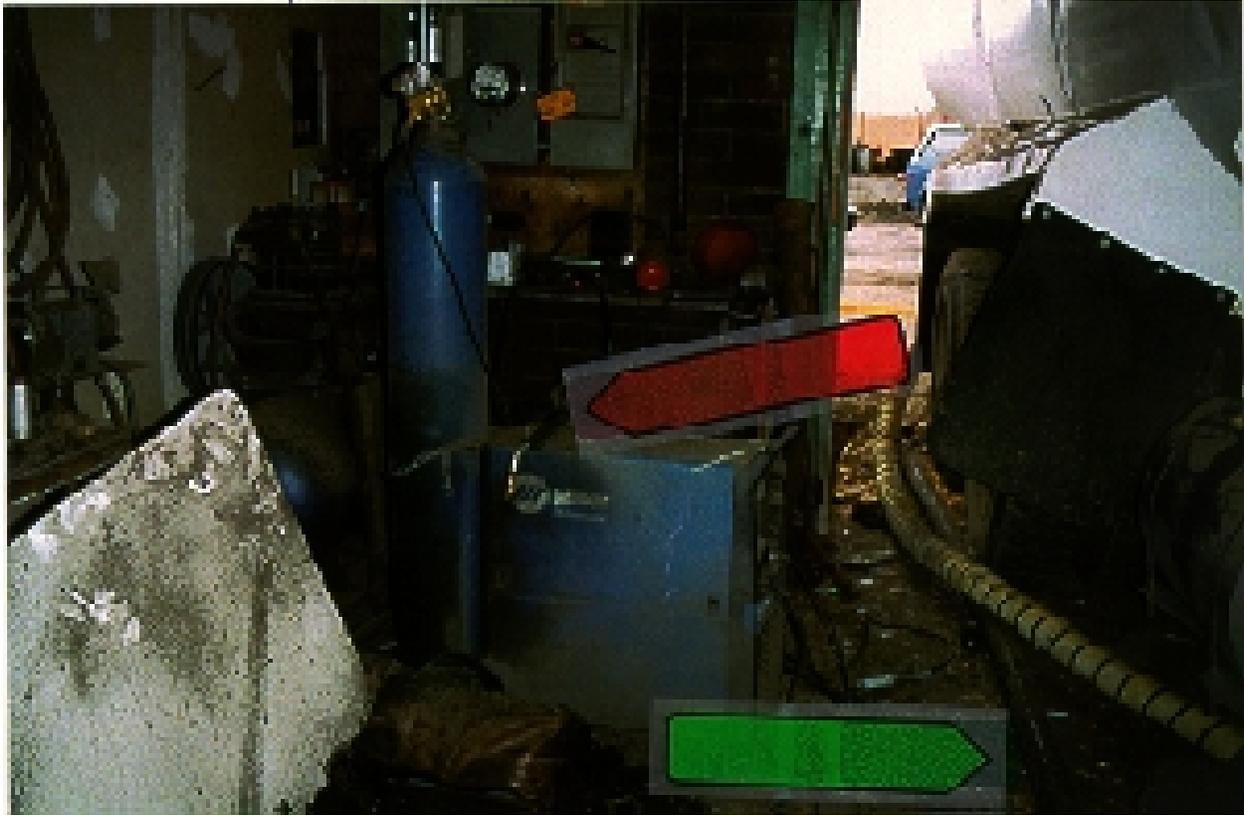
Photograph #4 – - Arrow shows the opening where the overflow pipe was to be welded.



Photograph #5 – Shows overflow pipe elbow. Arrow shows where a welding arc had been struck.



Photograph #6 – Shows the overflow pipe situated on the shop floor.



Photograph #7 – Shows the wire feed welder’s position with respect to the tank truck. Green arrow [lower arrow] shows the overflow pipe location. Red arrow [upper arrow] shows the welding stinger used to strike the arc.

Laboratory Analysis of Tank Truck Wastewater

Hydrocarbon
methane
ethane
butane
pentane
hexane
heptane
octane
nonane
decane
undecane
dodecane

Carbon Range	B.P.	Mass Fraction	Mole Fraction	Concentration (ppm)	M.W.
C1	-161.5	0.91	0.97	3644	16
C2	-88.5	0.02	0.01	51	30
C3	-42.1	0.02	0.01	35	44
C4	-0.5	0.01	0.00	13	58
C5	36.1	0.01	0.00	11	72
C6	68.7	0.00	0.00	4	86
C7	98.4	0.00	0.00	0	100
C8	125.7	0.00	0.00	0	114
C9	150.8	0.00	0.00	2	128
C10	174.2	0.00	0.00	1	142
C11	196	0.00	0.00	0	156
C12	216	0.00	0.00	1	170
TOTALS		1.00	1.00	3761	
AVERAGE MOLECULAR WEIGHT					17
DETECTION LIMIT-10PPM PER CARBON RANGE					

CARBON RANGES FOR B.T.E.X.	
Benzene	C6-C7
Toluene	C8
Ethylbenzene	C9
Xylenes (o,m & p)	C9