

**WORKER INJURED DURING A  
FLAMMABLE LIQUID  
EXPLOSION**

**Date of Incident: April 17, 2000**

**Type of Incident: Fatal**

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**Section 1.0 FILE NUMBER**

1.1 247329

**Section 2.0 DATE AND TIME OF INCIDENT**

2.1 April 17, 2000 at approximately 5:07 p.m.

**Section 3.0 DATE AND TIME OF INVESTIGATION**

3.1 April 17, 2000 at 7:45 p.m.

**Section 4.0 NAME OF INVESTIGATOR(S) (INTERNAL)**

4.1 LYNES, Monty  
Occupational Health and Safety Officer

4.2 BARRY, Verleen  
Occupational Health and Safety Officer

**Section 5.0 INCIDENT REPORTED BY**

5.1 Edmonton Police Service (EPS)

**Section 6.0 DATE AND TIME INCIDENT WAS REPORTED**

6.1 April 17, 2000 at 6:30 p.m.

**Section 7.0 NAME & ADDRESS OF PRINCIPAL STAKEHOLDER(S)**

7.1 **Owner(s)**

7.1.1 Place-Crete Systems Ltd.  
16410 - 130 Avenue  
Edmonton, AB T5V 1J8

7.2 **Prime Contractor**

7.2.1 N/A

7.3 **Employer**

7.3.1 Place-Crete Systems Ltd.  
16410 - 130 Avenue  
Edmonton, AB T5V 1J8

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

8.1 The employer employed 20 workers (including 4 office staff) to build, restore, finish and apply protective finishes on various masonry concrete structures. The employer maintained 3 work crews on various jobs.

**Section 9.0 LOCATION OF INCIDENT**

9.1 Northeast corner of the work site located at 16410 - 130 Avenue, Edmonton, Alberta.  
[City of Edmonton plan 7622386, Block 4, Lot 3B]  
(See Attachment "A", Photograph #1 and Attachment "B", Sketch)

**Section 10.0 EQUIPMENT AND MATERIAL INVOLVED**

10.1 1 - 205 l (45 Imperial Gallons) capacity drum of Asphalt Primer (approximately one third full).

10.1.1 An examination of the drum revealed a small puncture hole in the top outer edge of the drum. The puncture hole was approximately 5.1 mm from the outer edge of the drum, which appeared to be concurrent with the work activity of utilizing a cutting torch. (See Attachment "A", Photograph #2 and Photograph #3)

10.1.2 The steel drum was standard supply and the top plate (lid) measures approximately 0.9 mm to 1.2 mm (20 to 18 gauge) thick.

10.1.3 An examination of the interior of the drum revealed a heat line that indicated the drum was approximately one third full of asphalt primer at the time of the explosion.

10.1.3.1 A heat line is a shadow and/or burn line left behind during a liquid/vapour fire. It is created from the by-products of combustion.

- 10.2 The Asphalt Primer comprised of approximately 40% Asphalt (a complex mixture of high molecular weight saturated hydrocarbons) and approximately 60% Kensol 17 (a Petroleum Naphtha organic solvent). The organic solvent is emulsified in the asphalt base by the manufacturer to produce the Asphalt Primer.
- 10.2.1 The Asphalt Primer falls within the criteria governed by the Federal Hazardous Products Act (Workplace Hazardous Material Information System [WHMIS]) and some general properties of the product included:
- |                           |   |
|---------------------------|---|
| WHMIS Classification      | B2 (Flammable Liquid); D2B (Poisonous Material) |
| Physical State            | Liquid  |
| Appearance                | Black-Brown                                     |
| Odour                     | Tar odour                                       |
| Flash Point               | 28°C (82°F)                                     |
| Auto Ignition Temperature | 257°C (495°F)                                   |
| UEL/LEL Range             | 1.3% to 6.0%                                    |
- 10.3 1 – Oxygen/Fuel System. The system comprised of one small acetylene compressed gas cylinder, one small oxygen compressed gas cylinder, a cutting torch, standard (multi-spiral reinforced rubber “T” grade) welding hoses and a portable cart/stand.
- 10.3.1 The temperature generated at the torch end of an oxygen/acetylene fuel system is approximately 3,480°C (6,300°F).
- 10.4 1 – 15.9 mm (5/8”) plain carbon steel plate with rough dimension 0.9 m by 0.9 m (3’ by 3’).
- 10.4.1 The scrap piece of plain carbon steel would weight approximately 103 kg (230 lbs.) based on the rough dimensions and the standard density of plain carbon steel equivalent to 0.283 lb/in<sup>3</sup>.
- 10.4.2 The melting point of steel, although varying slightly depending on composition and properties, is approximately 1,370°C (2,500°F).
- 10.5 1 – Placer II – GYP Crete Concrete Pump (1975 Model).
- 10.5.1 The GYP Crete pump is an industrial size piece of equipment used in mixing and transferring a final concrete mixture comprised of GYP Crete product, water, sand and aggregate.
- 10.5.2 GYP Crete is a trade name of speciality concrete. It is a self-levelling, pumpable, Gypsum (Calcium Sulphate) based cement.
- 10.6 A GYP Crete Gate. The gate is a hydraulically operated flap, attached to the main mixer with hinges, that interrupts the flow of mixed GYP Crete product to and from

the hopper and pump. The gate is made from a 15.9 mm plain carbon steel plate and measures approximately 266.7 mm wide and 127.0 mm high. (See Attachment “A”, Photograph #4)

- 10.7 At the time of the incident, weather conditions were approximately 8.5°C under sunny skies with Northerly winds at approximately 15 km/h.

#### **Section 11.0 NAMES OF OTHER INVESTIGATORS (EXTERNAL)**

- 11.1 City of Edmonton Emergency Response Department – Fire Investigation Branch
- 11.2 Edmonton Police Service – Economic Crimes Section, Arson Unit
- 11.3 Place-Crete Systems Ltd.

#### **Section 12.0 NARRATIVE DESCRIPTION OF INCIDENT**

- 12.1 On April 17, 2000 at approximately 7:00 a.m., the worker started his shift at the work site. The total number of workers on shift the day of the incident was 16 and the worker’s crew comprised of 6 workers.
- 12.1.1 The worker was employed as a general labourer. He performed various work activities on a GYP Crete crew, with his main function being the operator of the GYP Crete Pump, during the building, restoring, finishing and application of protective finishes on various masonry and concrete structures. In the course of his duties he periodically conducted various small maintenance and fabrication jobs.
- 12.2 The worker began his workday engaged in work activities involved in a GYP Crete pour in the downtown area.
- 12.3 The worker left the field work site, after the GYP Crete pour was completed, at approximately 11:30 a.m. and returned to the employer’s main shop.
- 12.3.1 Only office staff was present at the work site when the worker arrived.
- 12.4 At approximately 12:30 p.m. the worker began cleaning the GYP Crete pump and loading the employer’s five-ton trucks with materials and equipment in preparation for the next day’s GYP Crete pours.
- 12.5 At approximately 2:30 p.m. the worker’s supervisor arrived at the main shop. The worker, while still engaged in loading materials and equipment, asked the supervisor for direction on additional work duties. The supervisor indicated that a second gate

for the GYP Crete pump needed to be fabricated and the worker could perform those activities.

- 12.5.1 It was indicated that damage appeared on the GYP Crete Pump's gate from extended use. When damages become apparent the gate can no longer maintain a seal and must be replaced.
- 12.5.2 The work activity of replacing the manufacturer's GYP Crete Pump gate was the first time this work had been done by either the employer and worker (work activities included: removing the original gate and fabricating and reinstalling another gate).
- 12.6 At approximately 2:45 p.m. the supervisor left the main shop to evaluate the fieldwork downtown.
- 12.7 At approximately 4:40 p.m. the worker travelled across the street in one of the employer's pick-up trucks to acquire a piece of scrap metal to be used in the fabrication of the second gate. The worker conducted the transaction, obtained a scrap piece of plain carbon steel plate, and returned to the main shop. (See Attachment "A", Photograph #5)
- 12.8 Due to the heavy nature of the steel plate, the employee backed the truck up, with the steel plate loaded in the box of the truck, to the far north corner of the main shop. He then placed the steel plate on top of a 205 l drum, one third full, of Asphalt Primer.
- 12.8.1 The worker then parked the pick up truck in a designated stall and returned to the work activities on the GYP Crete pump.
- 12.9 At approximately 5:05 p.m., the worker called the supervisor on his cellular phone. The worker indicated to the supervisor that he was experiencing troubles removing the first gate from the GYP Crete pump.
- 12.9.1 The gate and attachments were saturated and coated with excess GYP Crete material. This condition contributed to the difficulties the worker was experiencing during the gate removal.
- 12.10 The supervisor indicated to the worker to discontinue his current work activities and wait until he arrived back at the main shop.
- 12.10.1 At the time of the incident, the supervisor was in the process of travelling back to the main shop and was approximately ten minutes away.
- 12.11 The worker proceeded to take a portable oxygen/acetylene cutting torch system to the rear, north corner, of the building where the steel plate was located. The worker then measured a 266.7 mm by 127.0 mm section, the dimensions of the GYP Crete pump gate, on the steel plate.

- 12.12 The worker ignited the oxygen/acetylene torch with a flint striker and commenced to cut the 266.7 mm portion of the steel plate.
- 12.12.1 From the evidence, the worker was cutting the steel plate into two sections. The worker was cutting along a measured line from one end of the plate to the other.
- 12.13 The steel plate was still located atop the 205 l drum of Asphalt Primer when the cutting activity commenced.
- 12.14 The worker had completed a cut of approximately 432 mm into the steel plate when the cutting torch's flame intersected and punctured a hole in the drum. (See Attachment "A", Photograph #5 and Photograph 6)
- 12.14.1 The worker's cut into the steel plate began to arc and cut into the barrel.
- 12.15 The introduction of an ignition source caused the vapours inside the drum to ignite. The vapours expanded causing the drum to rupture.
- 12.15.1 The rupture resulted in simultaneous events occurring: splitting the bottom section of the drum from the main body; throwing the main body of the drum through the air; throwing the steel plate; expelling the liquid contents of the drum, the Asphalt Primer, on the worker, materials and equipment surrounding the area; and knocking the worker to the ground.
- 12.15.2 The liquid contents readily ignited and contributed to and accelerated the ensuing fire.
- 12.16 At approximately 5:08 p.m., The Emergency Response Department was called to the scene.
- 12.17 At approximately 5:16 p.m., The Emergency Response Department arrived on scene and commenced to control the fire and found the worker.
- 12.18 Shortly thereafter the Edmonton Police Service and ambulance arrived on the scene. Once the Emergency Response Department safely contained the fire, the worker was attended to, pronounced dead at the scene and removed from the location.

### **Section 13.0 CONCLUSIONS**

- 13.1 The cause of the incident was an uncontrolled explosion of a flammable liquid and vapours brought on by an ignition source (See 13.2). The uncontrolled explosion was a direct result of a system failure that included inadequate Supplier & Workplace Labelling (See 13.3) and inadequate Worker Education & Instruction concerning a Controlled Product (See 13.4).

## 13.2 **Ignition Source**

13.2.1 The worker's cutting torch's flame intersected the 205 l drum of a flammable liquid introducing a heat source which in-turn ignited the vapour inside the drum causing the explosion and ensuing fire. The temperature range of the oxygen/acetylene fuel system was over 10 times greater than the auto ignition temperature of the Asphalt Primer. (The Auto Ignition Temperature is the temperature at which a product self ignites.)

## 13.3 **Inadequate Supplier & Workplace Labeling**

13.3.1 The employer did not ensure a supplier label, workplace label or other means of identification was present on all controlled product containers present at the work site. The supplier labels provide information on the flammable nature of the controlled product, including the Workplace Hazardous Material Information System (WHMIS) flammable liquid symbol and statements on precautionary measures.

13.3.2 It was observed that supplier labels were either removed or damaged on various Asphalt Primer containers located on the work site. (see Attachment "A", Photograph #7 and Photograph #8). It could not be determined who removed these labels.

13.3.3 Although there was evidence of supplier labels not present on a number of Asphalt Primer containers, it could not be determined if a supplier label was present on the container involved in the explosion.

## 13.4 **Worker Education & Instruction Concerning a Controlled Product**

13.4.1 The employer did not provide worker education in the procedures for the safe use, storage and handling of a controlled product (Asphalt Primer).

13.4.2 An Asphalt Primer material safety data sheet, reflecting the flammable properties of the product, was available at the work site. The worker did not have the appropriate training to provide the worker with a system of recognizing the hazards associated with the product.

## **Section 14.0 FOLLOW-UP/ACTION TAKEN**

### 14.1 **Alberta Human Resources & Employment**

14.1.1 On April 17, 2000 a Client Contact Report complete with orders to comply were left with the employer. Orders were given to the employer on Hot Work, Direction and Instruction to Workers and Known Safety Hazards.

14.1.2 On April 18, 2000 the investigating officers met with the employer's management team from both the Calgary and Edmonton Regional Offices. Direction was given to the employer to conduct a Post-Event Health and Safety Audit.

14.2 **Employer**

14.2.1 On April 17, 2000, the employer ceased welding and cutting activities on the work site until a complete internal evaluation and investigation was completed.

14.2.2 On April 19, 2000, the employer completed the accident investigation with intermediate resolutions and long term solutions. A copy of the report was forwarded to Alberta Human Resources and Employment, Workplace Health and Safety for review.

14.2.3 The employer will be conducting an External Post Event Health and Safety Audit and submitting it to Alberta Human Resources and Employment, Workplace Health & Safety for review.

14.3 **Additional Measures**

14.3.1 Alberta Human Resources and Employment, Workplace Health and Safety will conduct a follow-up general work site inspection, utilizing the Client Contact Report, of the employer's facilities in both locations (Edmonton and Calgary).

14.3.2 Alberta Human Resources and Employment, Workplace Health and Safety will produce, in co-operation with the Alberta Construction Safety Association and the Manufacturer's Health and Safety Association, an Industry Alert Bulletin.





Red Arrow [top, centre]  
Yellow Arrow [middle, left]  
Blue Arrow [middle, right]

Example of spray from contents of drum.  
Worker was found here.  
Barrel was located here.

Photograph #1

View of the location where the worker was performing the cut on the 2051 drum.



Red Arrow [bottom, left]  
Yellow Arrow [top, left]  
Blue Arrow [bottom, right]

Puncture  
Bottom section  
Top

Photograph #2

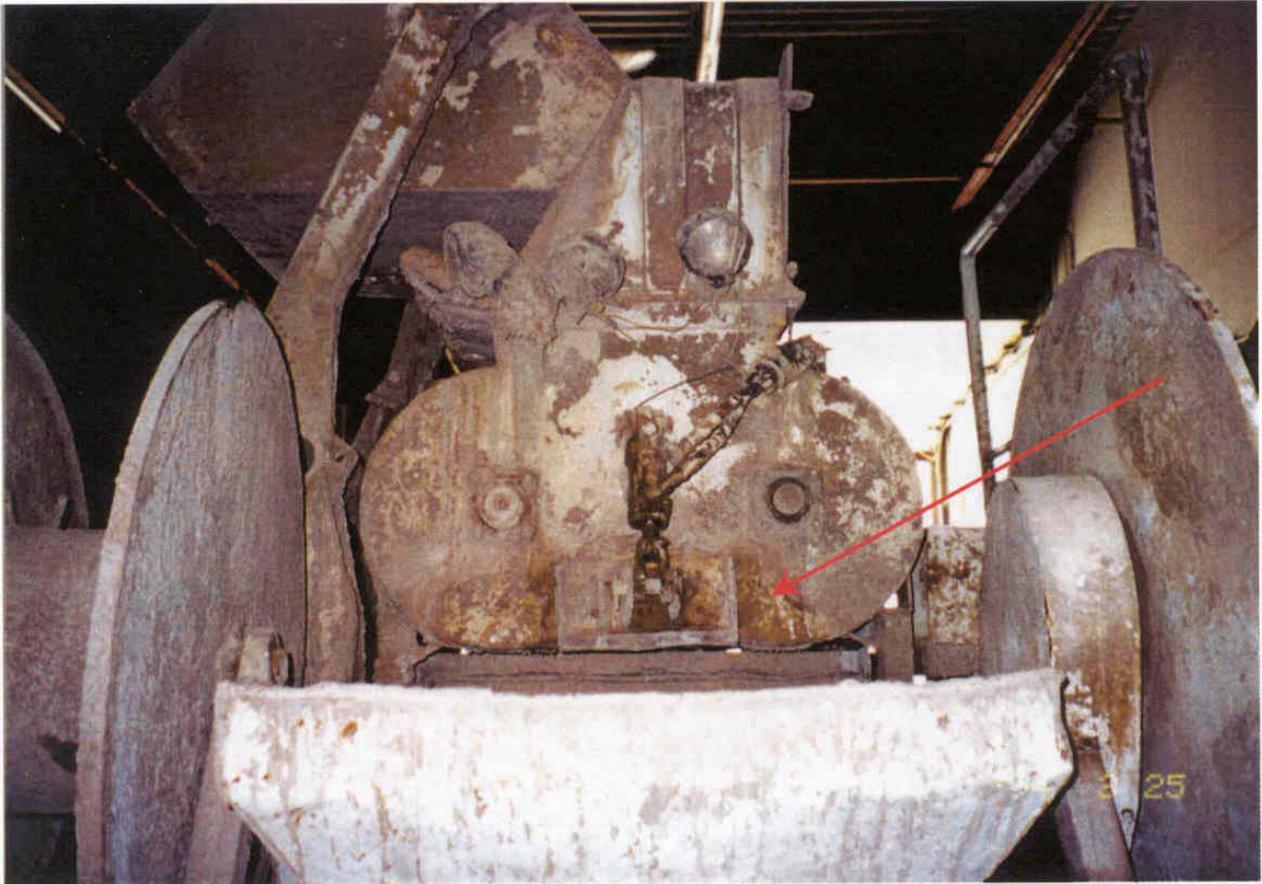
The 2051 drum of Asphalt Primer the worker utilized as a worktable. (See Photograph #3)



Red Arrow [bottom, centre]

Puncture

Photograph #3 Close up view of the puncture hole left in the 2051 drum from the cutting torch activity (See Photograph #2).



Red arrow [centre, right] Gate

Photograph #4 Rear view of the GYP-Circle Pump



Red arrow [bottom, right]      Cut made by the torch

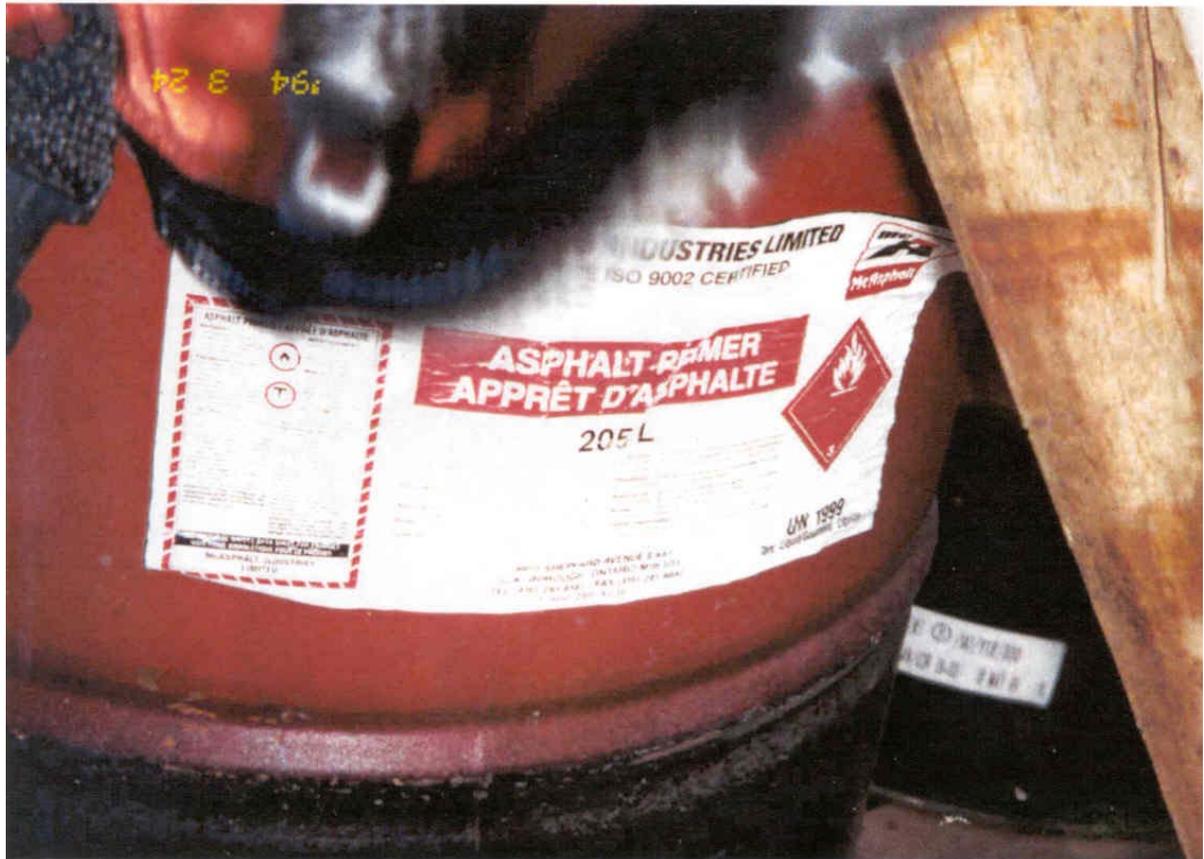
Photograph #5

The 15.9 mm x 0.9 m x 0.9 m plain carbon steel plate.  
(See Photograph #6)



Red Arrow [bottom, right] 205 1 drum  
Yellow Arrow [middle] Steel plate

Photograph #6	Example of the position of the steel plate during the cut. (See Photograph #5)
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Photograph #7

View of a supplier label attached to a container of Asphalt Primer (See Photograph #8).

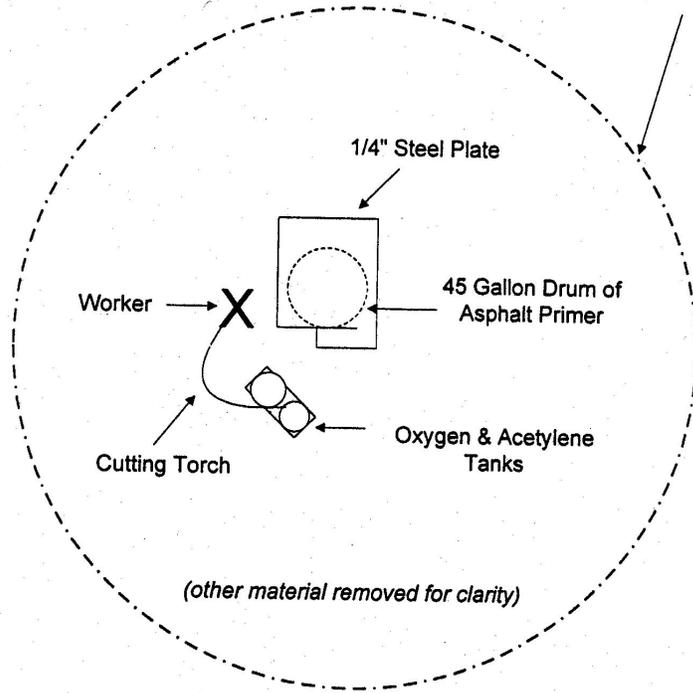
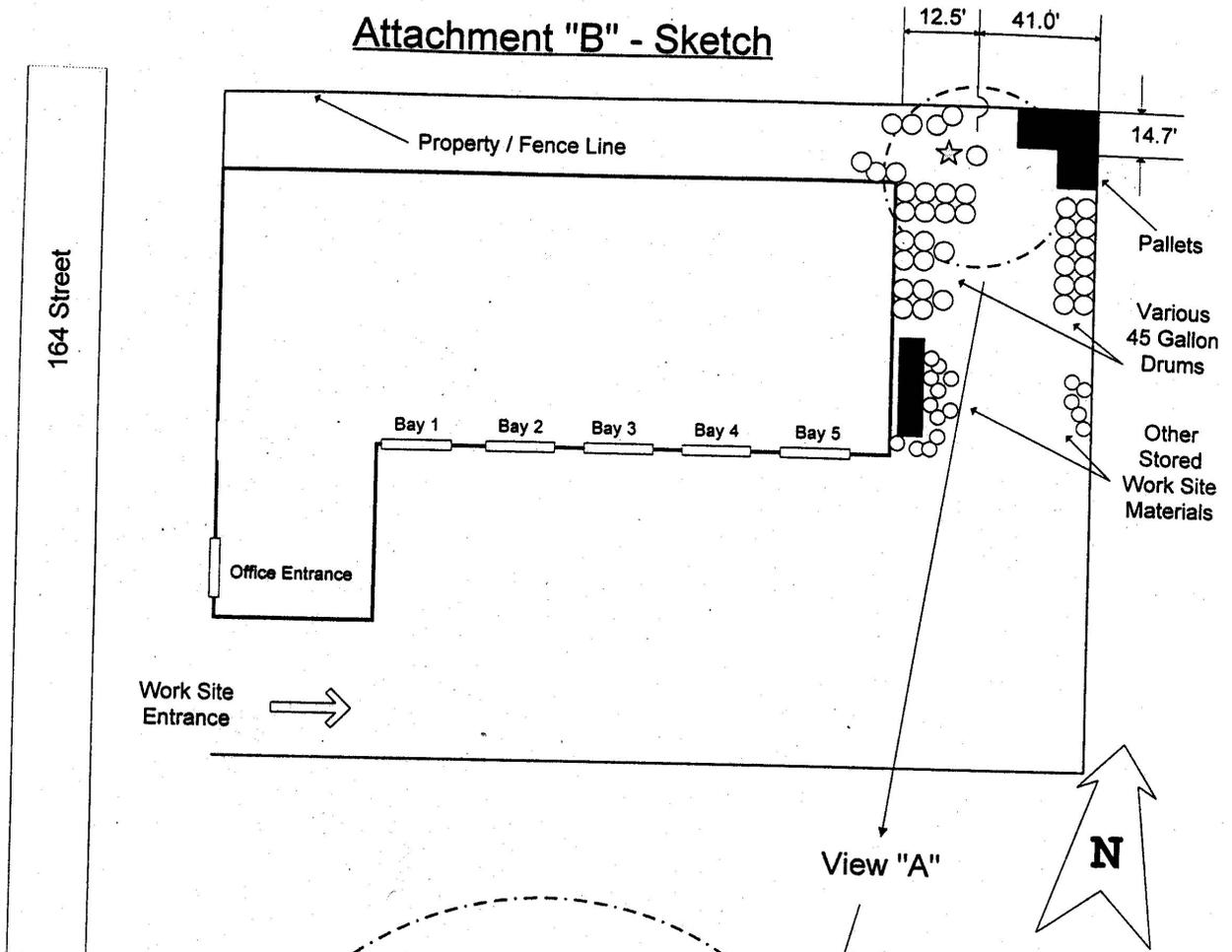


Red arrow [centre] No label

Photograph #8

View of an Asphalt Primer container without an appropriate supplier label (See Photograph #7).

### Attachment "B" - Sketch



Drawn by M. Lynes 00 04 26  
\*Not to Scale\*