

Florida Rural Water Association

Presents a non-diluted view of
inflow and infiltration

By
Allen Slater

- What is inflow and infiltration?
- Inflow is the rainwater taking a direct path into the collection system through some sort of opening in the collection system such as open or broken cleanouts, damaged manholes, etc.
- Infiltration is rainwater that has soaked into the soil and is now basically part of the water table and is finding its way into the collection system through bad seams on manholes, bad joints or broken pipes, unsealed lift holes, etc.

- To put in perspective one inch of rain on one surface acre is roughly 27,000 gallons.
 - So just one broken cleanout during an average thunderstorm can put you over your permitted capacity.

- How can we determine if we need to do an Inflow and Infiltration study?
 - Easy, compare flows from your drinking water facility with your wastewater facility. Are the drinking water flows a lot less?
 - Also chart your wastewater flows with the rainfall. Do we see immediate increase in flows during a rain event?

- My favorite is checking elapsed time meters on all lift stations, so you know which neighborhoods are a good place to start.
 - Also, it is a good practice to check lift stations in the early morning hours like 1:00 am seeing if there is flow and how heavy. Then checking each manhole following the flow upstream to where it originates.

Why care if we have direct inflow
or infiltration into our collection
system?

Bottom line the costs related to needlessly treating rainwater. Not to mention the regulatory aspect.

Costs such as:

1.Electricity

2.Wear and tear on pumps

3.Extra chemicals due to increased flow

Can anyone name some others?

- Other issues are reduced treatment capacity due to sand and grit filling up treatment basins, which can cause effluent violations as well.

- What are some of the things that can happen when we exceed permitted capacity due to rain?
 - Facility has solids washout due to hydraulic overload.
 - Chance for filamentous bacteria to be introduced to facility.
 - What else?

Everyone's favorite, fan mail
from your local Regulatory
Department.

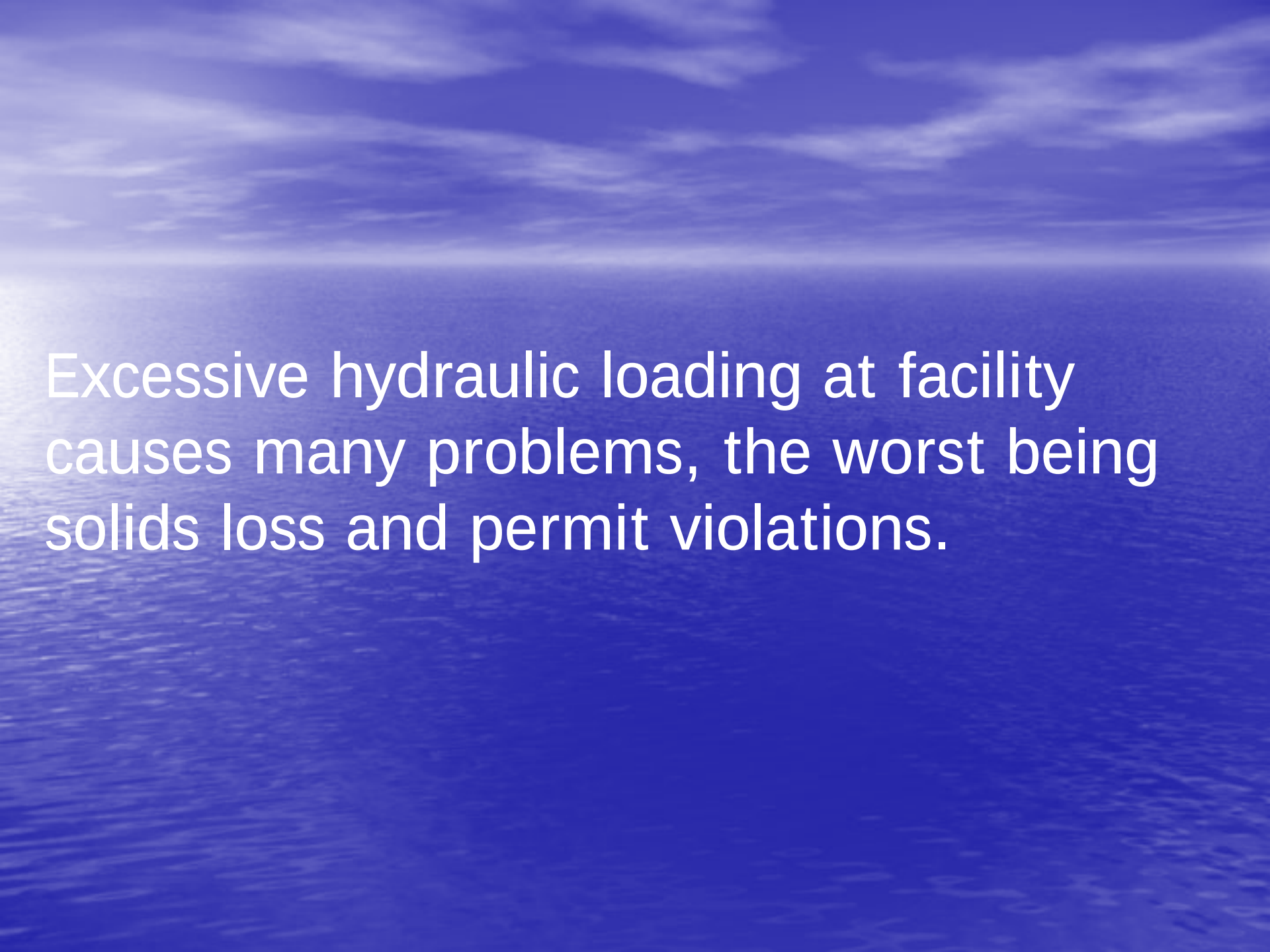
The August, September, October, and November 2004 discharge

**monitoring reports (DMRs) reported flows of
55 %, 61 %, 56 %, and 51 %**

respectively. F.A.C. Rule 62-600.405(3) requires that
when the three-month
average daily flow for the most recent three consecutive
months exceeds 50
percent of the permitted capacity of the treatment plant
or reuse and disposal
systems, the permittee shall submit to the Department a
capacity analysis
report.

62-600.405 Planning for Wastewater Facilities Expansion

- (1) The permittee shall provide for the timely planning, design, and construction of wastewater facilities necessary to provide proper treatment and reuse or disposal of domestic wastewater and management of domestic wastewater residuals.
- (2) The permittee shall routinely compare flows being treated at the wastewater facilities with the permitted capacities of the treatment, residuals, reuse, and disposal facilities.



Excessive hydraulic loading at facility causes many problems, the worst being solids loss and permit violations.

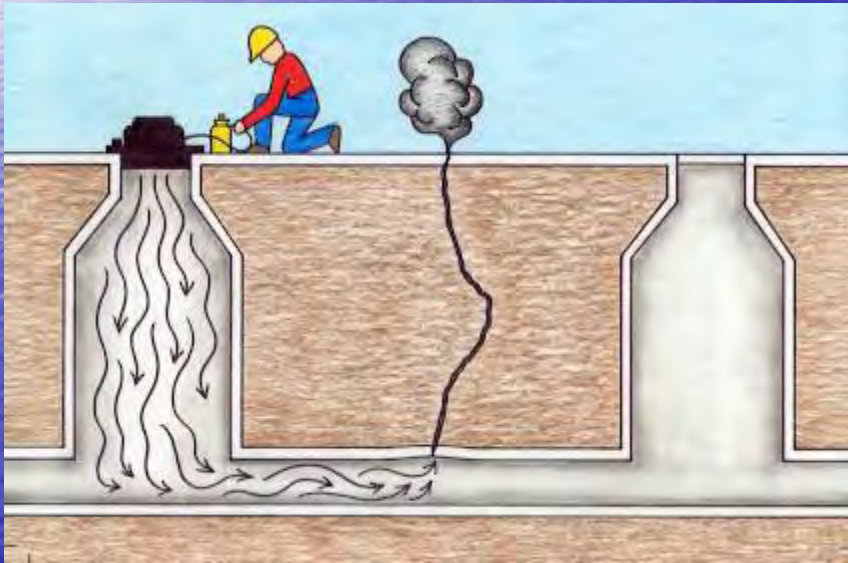
- Remember one inch of rain on one surface acre = roughly 27,000 gallons of water, which equals money down the drain.







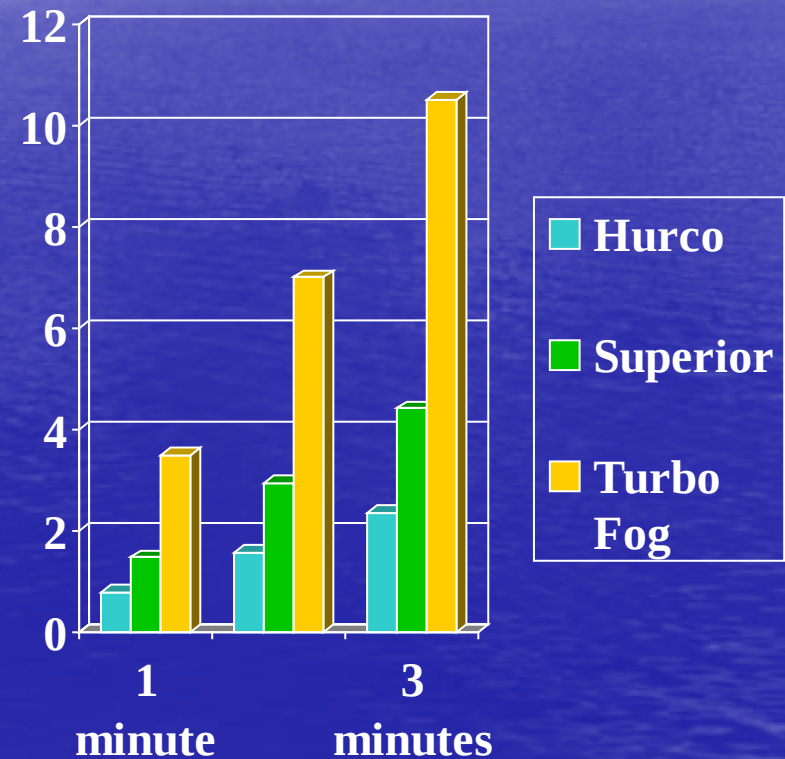
Why Smoke Testing?



- **Smoke testing is the most efficient and cost effective way to locate and identify these inflow and infiltration problems.** TV inspection can only identify these problems when water tables are high or there has been a recent rain.

Cost of Smoke In Minutes:

- **Using LiquiSmoke, the cost of the smoke can run as low as \$2.34 per 3 minutes of use.** This graph shows cost per minutes in dollars for each of the manufactures. The figures on the left are dollars.



- Hurco has MSDS sheets and Test Data for its LiquiSmoke. All test are conclusive, LiquiSmoke is 100% safe. It contains no harmful products.

- Hurco also has a NIOSH report on the dangers of Zinc Chloride.

LiquiSmoke - 100% Safe - Leaves No Residue

Some of the preparations needed to conduct a smoke test on your collection system.

1. Review the smoke test information packet, that I email out to those who request a smoke test.
2. Ensure that all the manhole locations are known and accessible, and that the machine will work on manhole.
3. Notify the residents.
4. Notify the fire department.
5. Gather needed items such as paint, stakes, etc.

Smoke Testing Agreement

In consideration of the mutual covenants contained herein; it is agreed between the Florida Rural Water Association (FRWA) and _____ (System), as follows:

The Florida Rural Water Association makes this service available to member wastewater systems in an effort to reduce inflow and infiltration into their wastewater collection systems.

For smoke testing, the Florida Rural Water Association (FRWA) will provide the following:

1. Smoke testing equipment for use in inflow and infiltration studies.
2. Sample letter of recommendations for wastewater systems to use in notification of customers of pending smoke testing project. FRWA accepts no responsibility for customer notification; customer notification is the responsibility of the wastewater system. If the FRWA field representative finds that customer notification has not been performed, the smoke test will be suspended until proof of customer notification has been performed. This proof must meet the satisfaction of FRWA. FRWA accepts no responsibility in the event that smoke enters a home or residence.
3.
 - A. FRWA field person to assist in manhole inspection program for systems with fewer than one thousand (1,000) connections.
 - B. FRWA field person for one (1) day of training of wastewater systems personnel in what to look for in a manhole inspection program for systems over one thousand (1,000) connections.
4.
 - A. FRWA field person to assist in smoke testing for wastewater systems under one thousand (1,000) connections.
 - B. FRWA field person to provide one (1) day of training of wastewater system personnel on proper smoke testing procedures for systems with over one thousand (1,000) connections.

The member wastewater system will provide the following:

1. No less than two (2) people familiar with the wastewater collection system to assist FRWA personnel in inspection of system.
2. System will be responsible for purchase of smoke product, gas for smoke blower and other necessary supplies (see cover letter).
3. System will provide all necessary employees' insurance coverage and safety equipment for use by wastewater system personnel (not FRWA employees).

DATE

FRWA

SYSTEM

FLORIDA RURAL WATER ASSOCIATION

2970 WELLINGTON CIRCLE WEST • SUITE 101 • TALLAHASSEE, FL 32309-6885
(850) 668-2746
<http://www.frwa.net>

BOARD of DIRECTORS

ED HOBIN
Brooksville
President

DARRELL POLK
Boca Grande
Vice President

WILLIAM G. GRUBBS
Quincy
Secretary/Treasurer

PAUL BRAYTON
Harbor Heights
National Director
Perry

ROBERT MUNRO
Orlando

RON TRYGAR
Tallahassee

EXECUTIVE
DIRECTOR

GARY WILLIAMS
Tallahassee



Dear FRWA Member:

The Florida Rural Water Association (FRWA) looks forward to working with your system to address your Inflow and Infiltration (I&I) concerns.

In order for the FRWA staff to assist you in the smoke testing of your collection system, we request that you assemble the following materials prior to our arrival:

1. **'LiquiSmoke' smoke product.** Liquismoke may be purchased from various suppliers including the *USA Blue Book*. If you choose to order from the *USA Blue Book*, you may contact them at (800) 548-1234
Liquismoke One gallon jug Stock # 28459 Approx. \$50
Five gallon bucket Stock # 28460 Approx. \$185
2. **Marking paint, wooden stakes, flags or other method of marking holes**
3. **Gasoline for the smoke blower**
4. **A camera and film or a camcorder** (if you desire photographs or tape)
5. **100 feet of ¼ " or larger rope**
6. **At least six sewer plugs** (Large traffic cones work quite well, but can not be reused as cones, as we have to cut off the bases.)

In addition to compiling the list of materials, we will need you to provide the following: (We will confirm this prior to on-site trip to perform I&I reduction work.)

1. **Notification of the public, fire department, etc.** Non-notification of your customers could lead to a public relations and publicity problem. The Florida Rural Water Association is not liable for customer reactions to use of equipment or the assistance it offers. You may want to contact each customer individually, as well as include in your local paper, (see attached sample notification). Proof of notification will be required prior to starting work.
2. **Provide two or three people to be used as spotters during the smoke testing.** At least two helpers will be needed, who are capable of opening and closing manholes and carrying the smoke blowing machine from the truck to the manhole
3. **Involvement and assistance by the Fire Department can be very beneficial.**
4. **If you require cataloging of the collection system,** we ask that you number each manhole and provide a map to FRWA personnel. You will also be asked to provide multiple copies of the attached "Manhole Identification Sheet" (one for each manhole).

Upon completion of all requested items, please contact FRWA at (800) 872-8207 to schedule an appointment for FRWA to spend a day with your system to train your personnel or complete smoke testing depending upon system size. Most likely, you want to consider a three-day window to perform smoke testing in case weather doesn't allow testing on a specific day scheduled.

Again, FRWA looks forward to hearing from you and working with you on this worthwhile, important project.

Sincerely,
FRWA Wastewater Section

SPECIAL NOTICE

Dear Customer:

To better serve you, your utility will be smoke testing its sewers. This is done periodically to locate sources of sewer odors, leaks and breaks in sewer lines. The type of smoke used is harmless, white to yellowish-white in color, and may have a slight odor.

The smoke testing will occur sometime during the following dates:

between the hours of

until

You may notice smoke coming from building sewer vents, gutters and downspouts or out of the ground along sewer lines.

On the inside of your house, smoke or its odor may come out of the plumbing or fixtures. This should not happen if your plumbing is in good shape. This is also an indication gases and odors from the sewer may enter your house or building. These can be both unpleasant and dangerous as well as a health hazard to the occupants.

Location, identification and correction of the source of smoke entering your house or building is urgently advised. While the utility will render all possible cooperation, the correction of any defects in the pipes and sewer on private property is the responsibility of the house or building owner.

The smoke is harmless to plants and animals and leaves no residuals or stains. If smoke gets into your house, please ventilate your house.

If you have any questions or desire additional information, please contact your utility at ---



MAPS AND PRINTS

- **A sanitary sewer location map with measurements and locations.** This map will show where the manholes are and which direction the lines flow. It will also show you whether there are other lines such as force mains or cleanouts, etc. Usually, this map also helps with street names, addresses and the overall area sanitary picture. This is an excellent map to include your notes on. **Remember! Good notes will prevent delays on the job.**

Nothing takes longer than having to hunt manholes when your ready to smoke test, that are either buried or under units, also when you have non-standard manholes you have to make adjustments such as making your own frame or gasket.







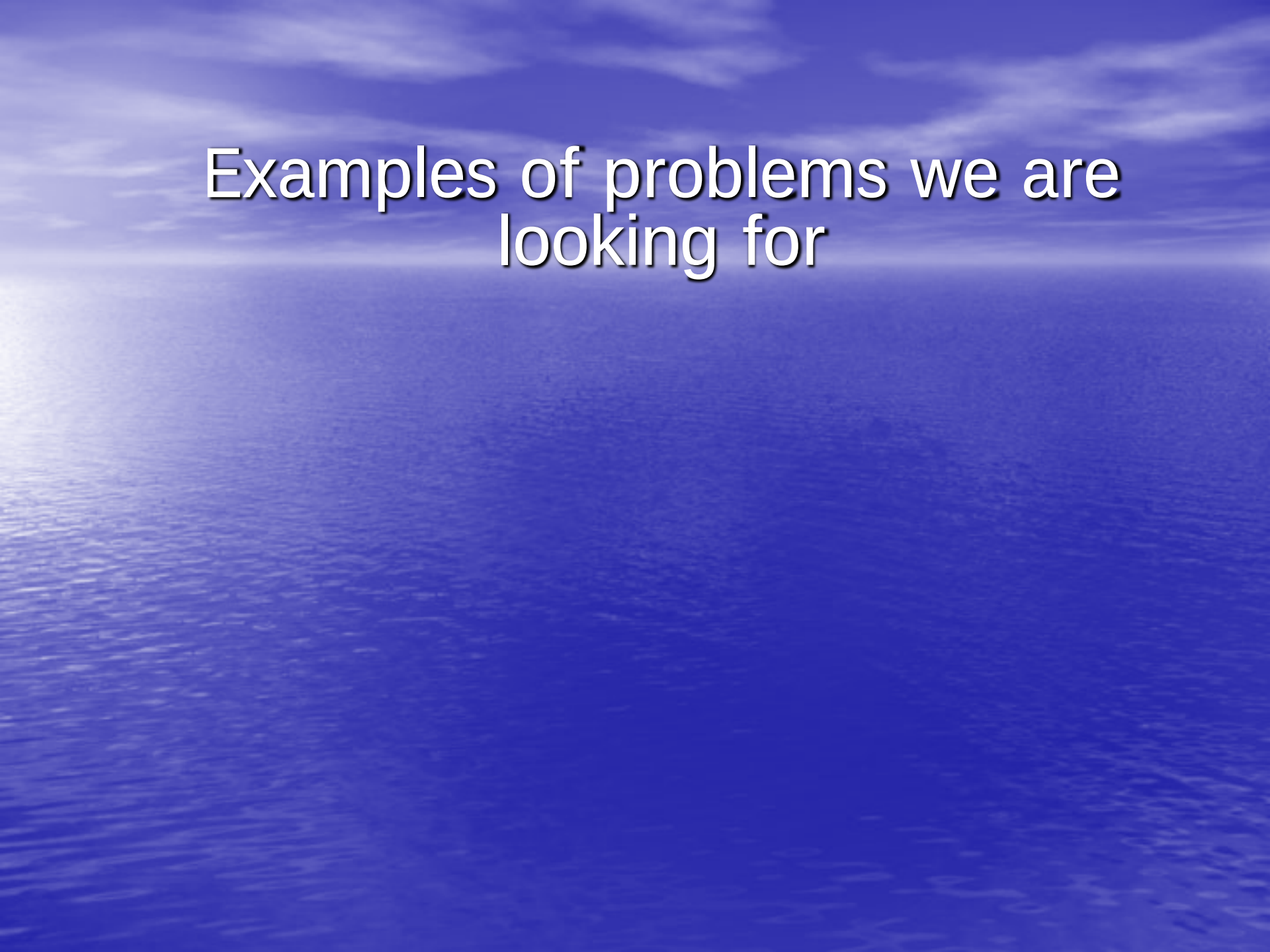












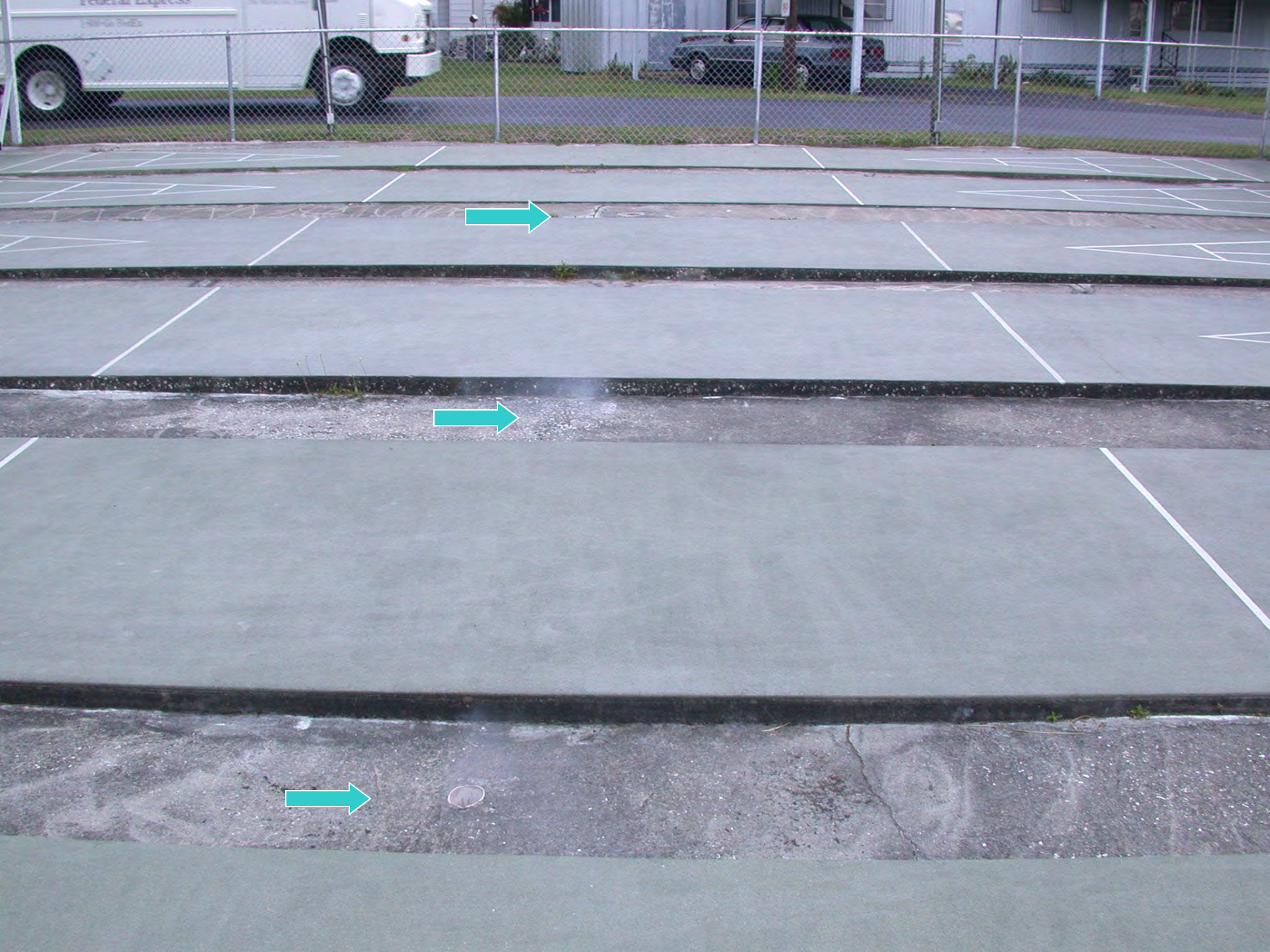
Examples of problems we are
looking for

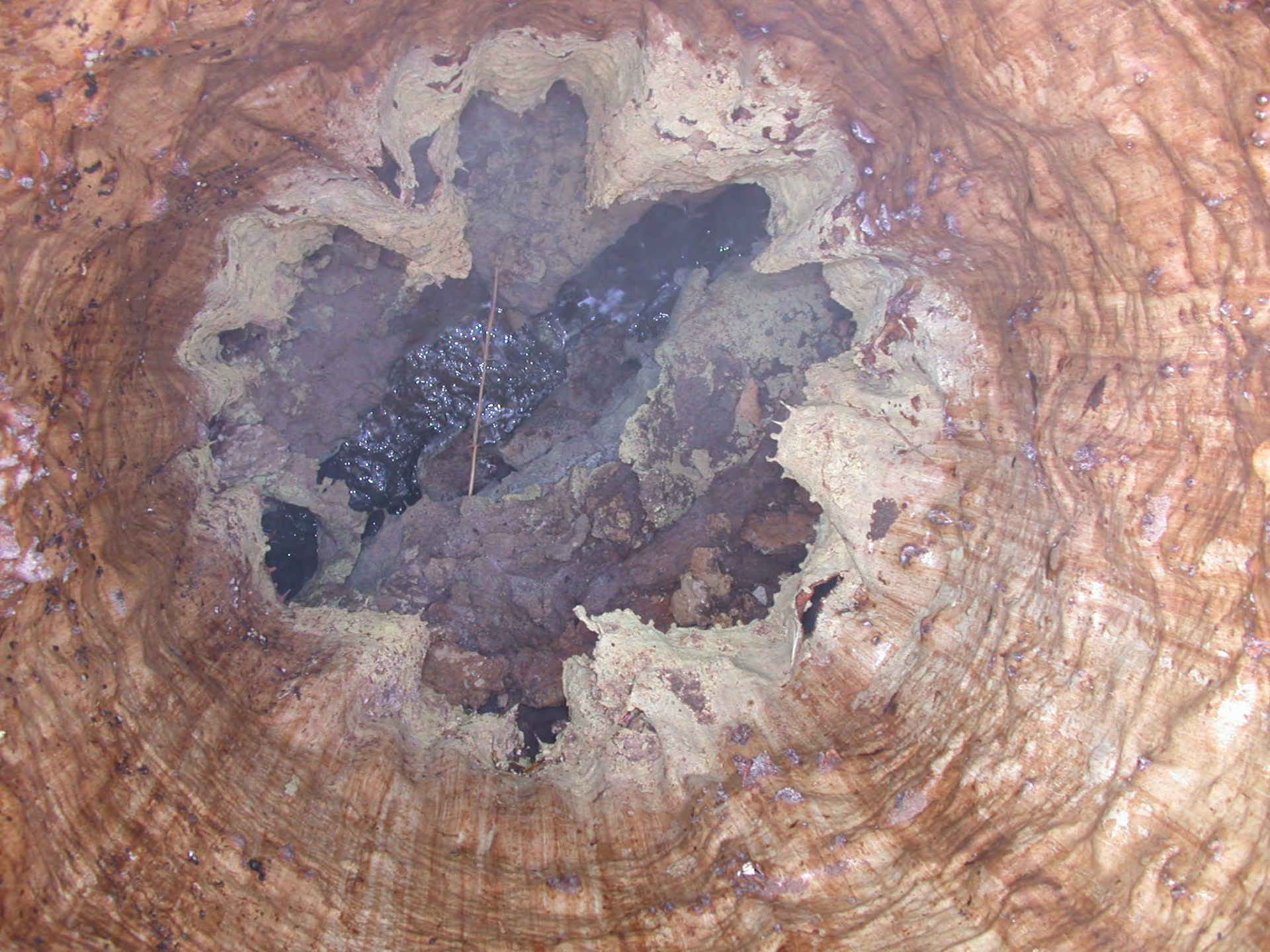






Picture of a broken 6-inch cleanout







In one year, the inflow from one illegally connected house roof is the same volume as the wastewater from 50 houses.





Defect: Manhole is in a bowl with a rain gutter directing water to it, needs raised to bring it above grade

Location: Unit 120



Defect: Manhole is in a bowl with a rain gutter directing water to it, needs raised to bring it above grade

Location: Unit 120













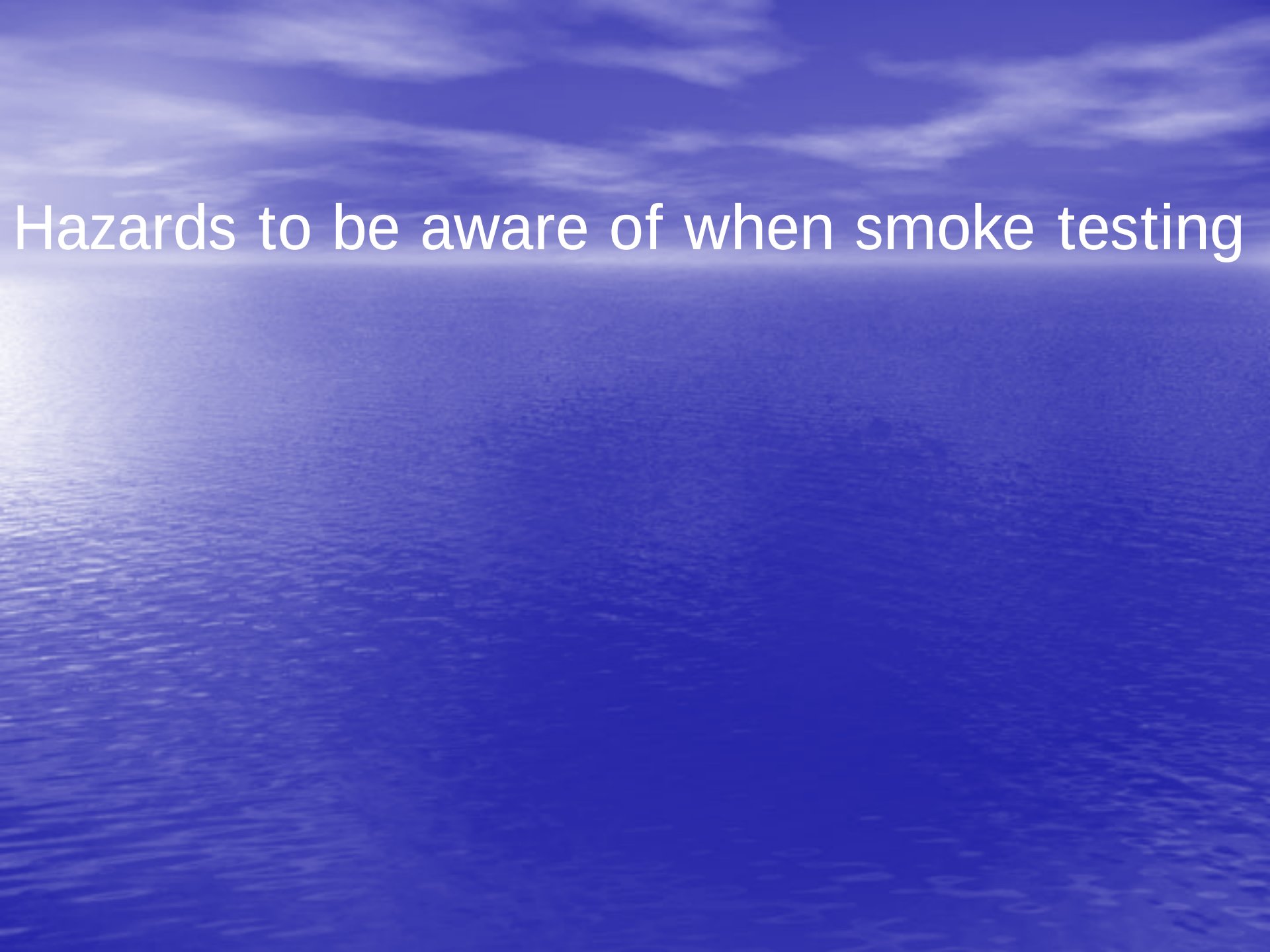










The background is a solid blue gradient. On the left side, there is a bright, circular light source, likely the sun, which creates a shimmering, wavy reflection that extends horizontally across the middle of the image. The reflection has a textured, rippling appearance. The overall color palette is various shades of blue, from a deep navy at the bottom to a lighter, almost white-blue at the top where the sun is located.

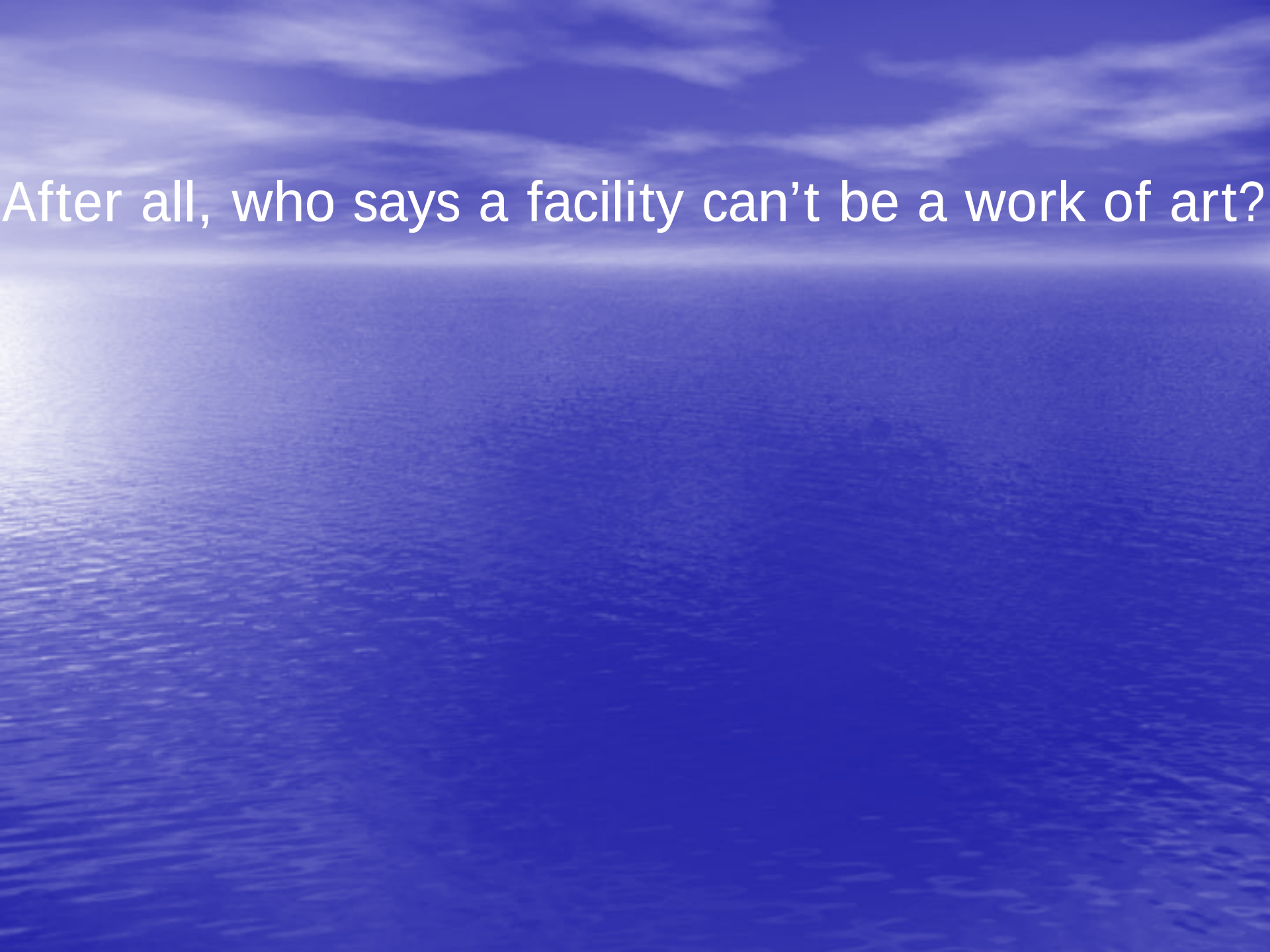
Hazards to be aware of when smoke testing









The background is a vertical gradient of blue. The top portion shows a sky with wispy white clouds. The bottom portion shows a calm ocean with subtle ripples. A bright, horizontal line of light separates the sky and ocean, suggesting a horizon or a reflection of the sun.

After all, who says a facility can't be a work of art?





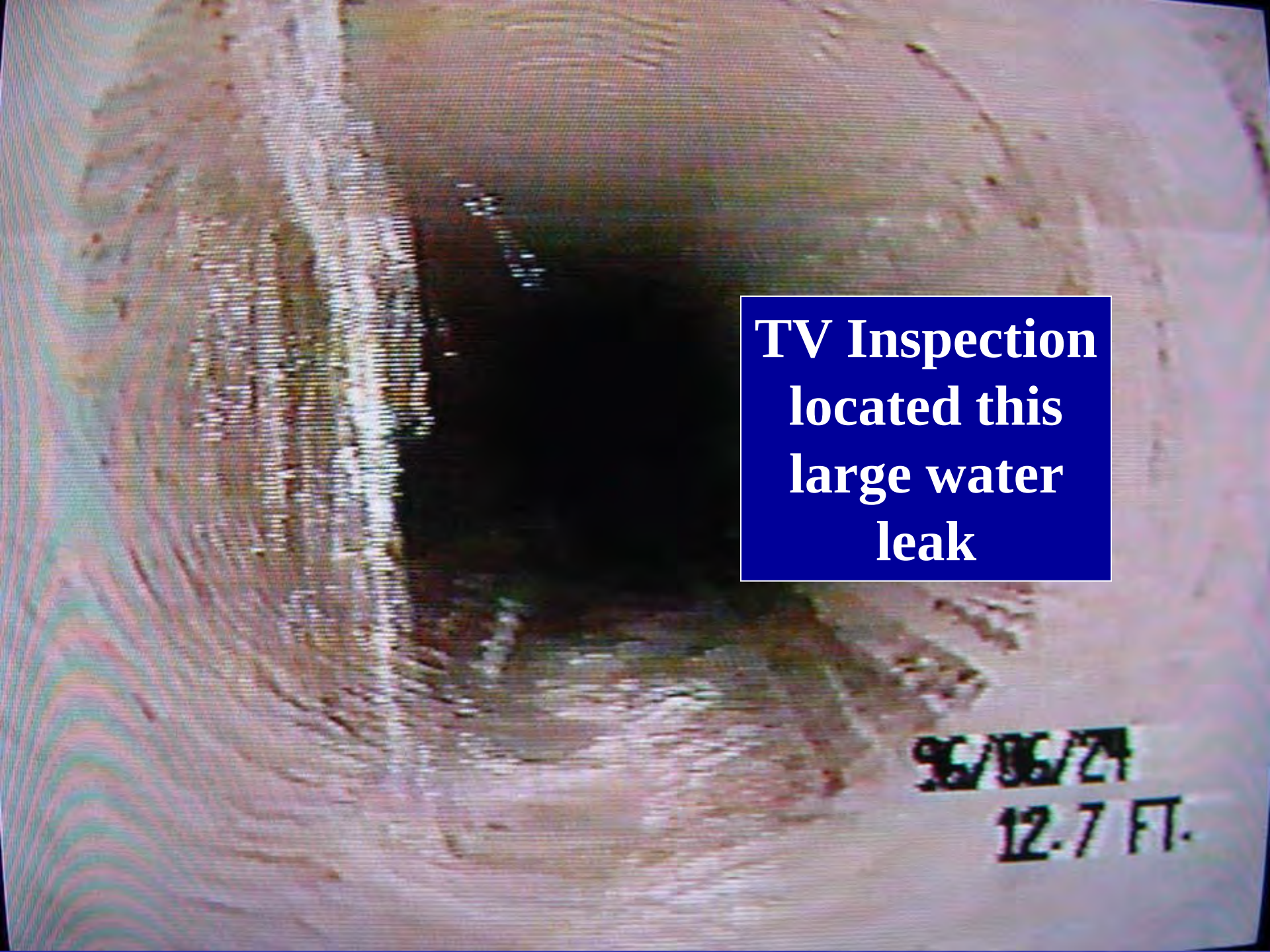
Closed Circuit TV Inspection

Closed Circuit TV Inspection

- Locates problems in pipes
- Locates damage to sewers
- Reveals unrecorded connections

Closed Circuit TV Inspection

- Locates sources of inflow and infiltration
- Inspect lateral connections
- Locate lost or buried manholes



**TV Inspection
located this
large water
leak**

**9/16/24
12.7 FT.**

Closed Circuit TV Inspection

- Prior to TV inspection, the sewer lines must be cleaned.



Sewer line cleaning nozzle

12/13/00 15:01
180.4 FT.



TV inspection can help locate

- Joint separations
- Offset joints
- Leaks
- Service connections

TV inspection can help locate

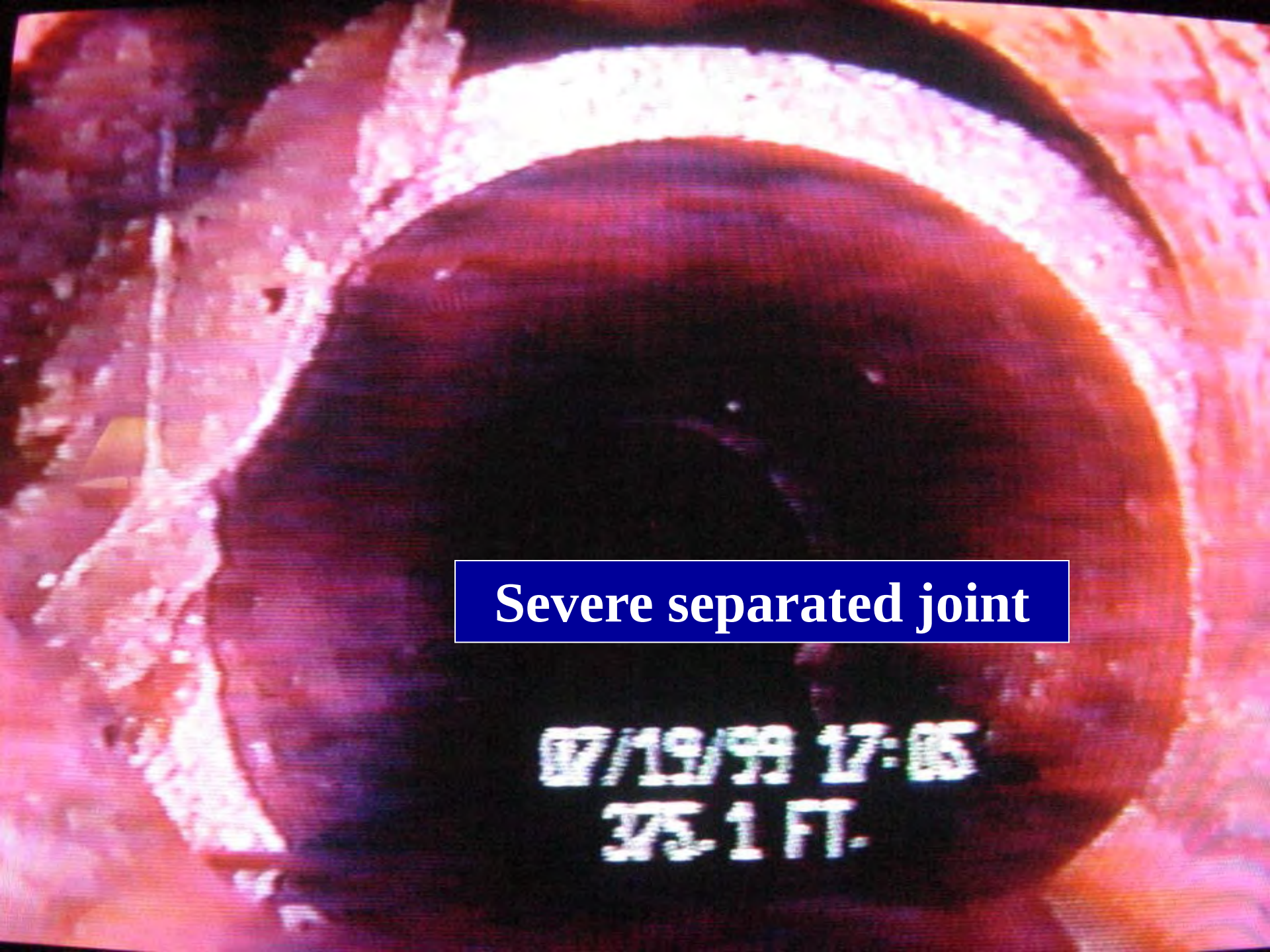
- Broken pipes
- Obstructions / blockages
- Manholes
- Bellies

TV Inspection Equipment



TV Inspection Equipment





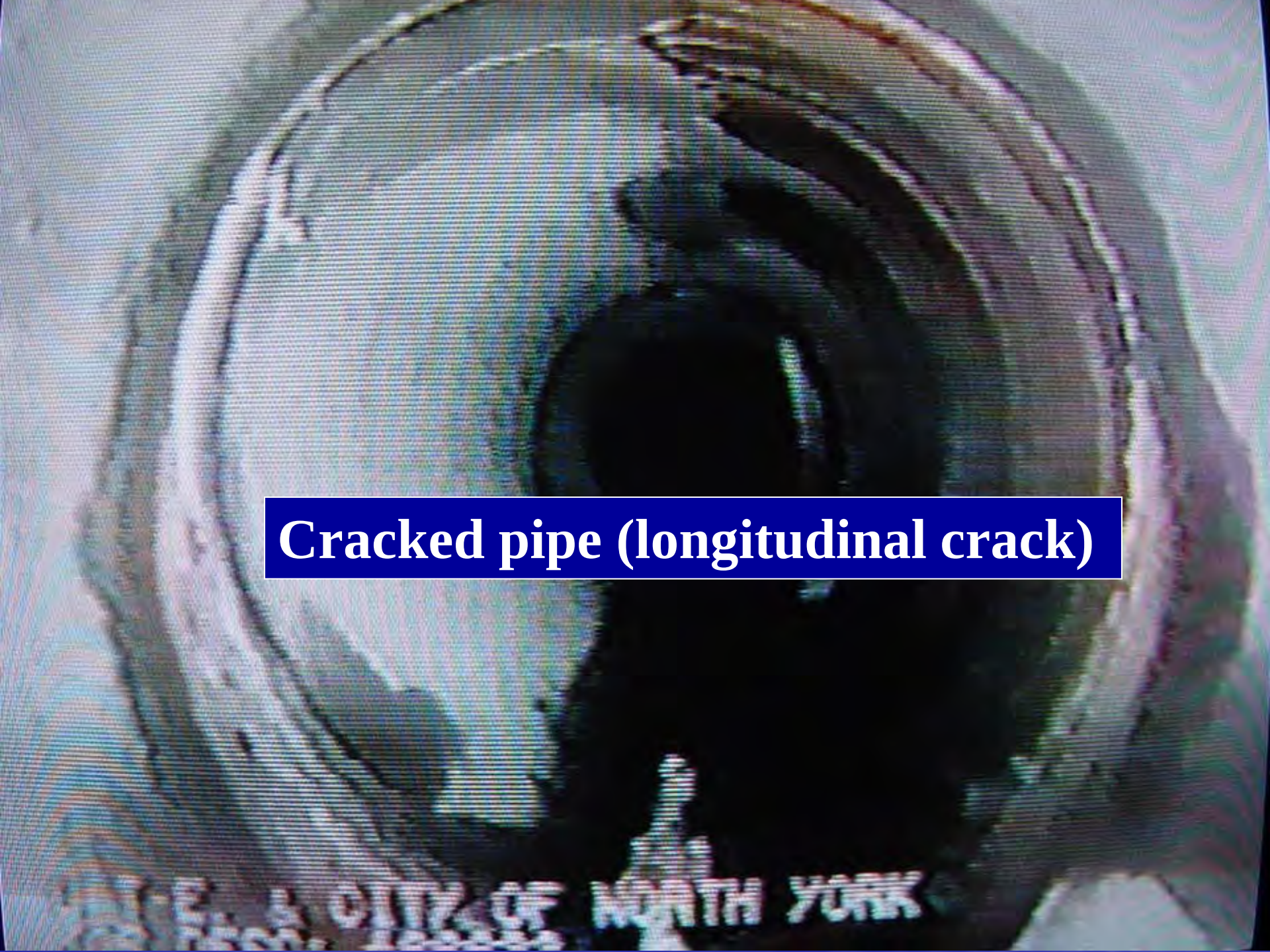
Severe separated joint

07/19/99 17:05
35.1 FT.

0029

Infiltration at service connection





Cracked pipe (longitudinal crack)

THE CITY OF NORTH YORK

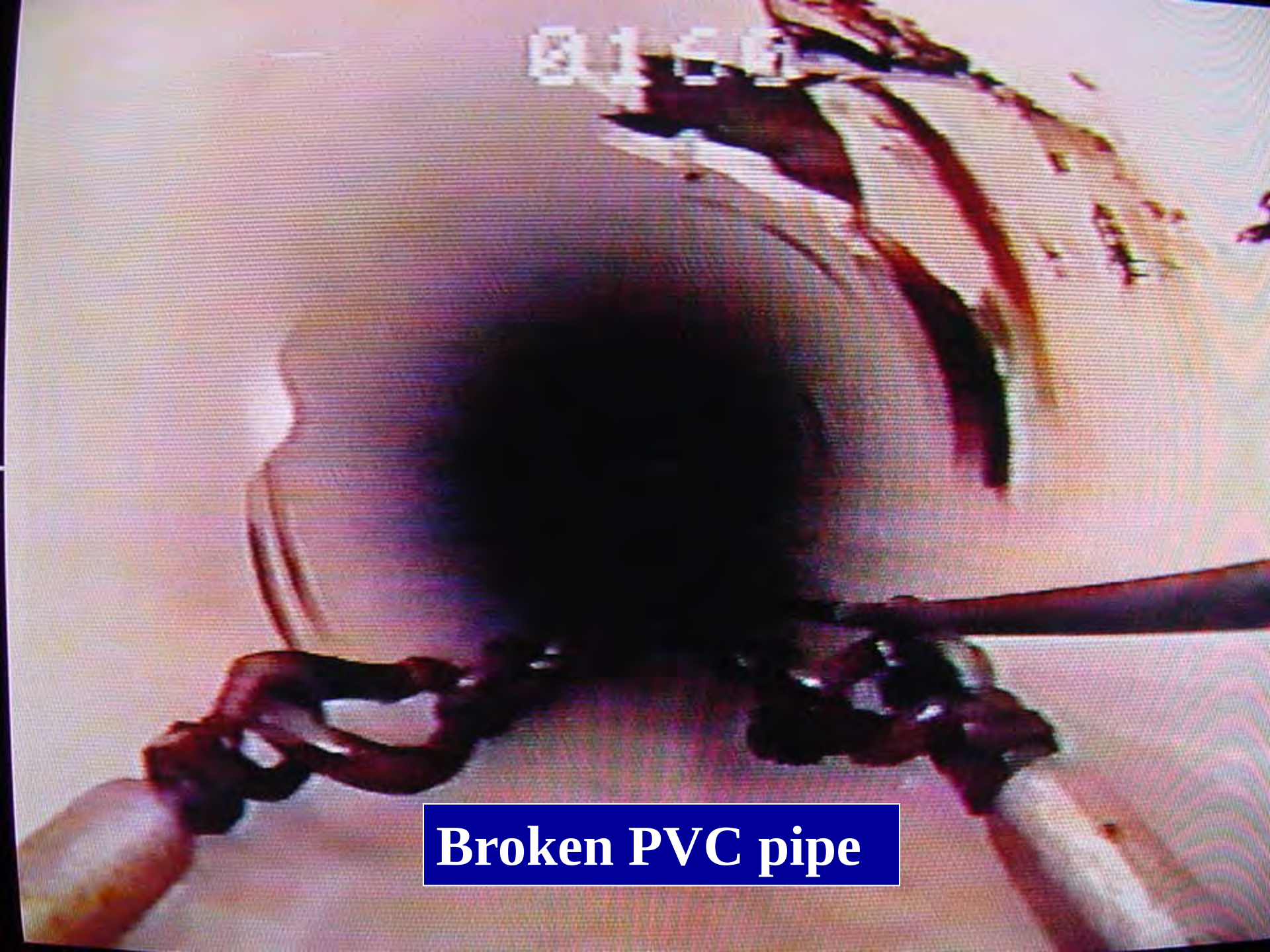
Heavy roots obstructing sewer

07/19/99 13:21
79.9 FT.



Severe offset joint

12/11/00 11:57
7.0 FT.



Broken PVC pipe

Service connection break-in

U. T. E. CITY OF NORTH YORK
HOB 1250 199533

A close-up photograph of a broken pipe. The pipe is dark and curved, with a jagged, broken edge on the right side. The interior of the pipe is visible, showing a dark, hollow space. There is some reddish-brown material, possibly rust or debris, on the upper part of the pipe's inner wall. The background is dark and textured.

Broken pipe (crown missing)



Crushed pipe

50524 84615
JOB DEC 15 1989
DISTANCE: 008.6



Sewer line inspector

Dangers of Sewer Inspection

- There is always a risk of the camera equipment becoming stuck in the sewer line
- Before digging up the sewer line, proper locates must be performed

Dangers of Sewer Inspection

- All lines must be located:
 - Gas mains
 - Fiber optic cables
 - Water mains
 - Cable TV
 - Electrical services