

Classroom Training Course Outline

Sewer Cleaning 102 Program of Study (7 Hours)

Element: **Course Introduction: Background of Sewer Cleaning 102**

Duration: **15 Min.**

Description of Class:

This introduction will discuss how this program of study was created from a compilation of the experiences of professional sewer maintenance workers and research and development. Our research and development practices will be explained. These results will be presented in documentation and video that will help bring clarity as to the best practices of their trade.

Topics covered include:

- Presenter/program developer background/history
- Types of evaluations that have been conducted
- How the evaluations were conducted
- The type of information gathered
- Present findings of pertinent information useful to individuals and industry as a whole
- Research conducted

The term *learning curve* is used in two main ways: where the same task is repeated in a series of trials, or where a body of knowledge is learned over time.

S-Curve (Sigmoid)

Learning

Experience

"Helping the Environment through Education."

Element: **Production and Cost Issues (Continuation of Course Intro)**

Duration: **15 Min.**

Description of Class:

This class will discuss the reasons why daily production rates are important (daily footages (l/f) of pipe cleaned). Daily production rates directly affect the cost of performing the services provided. An increase in daily production reduces overall cost and a reduction in production rate raises the overall cost of the services provided. The attendees will receive valuable information designed to influence the awareness of cost and how they can directly affect the reduction of cost. They will become more aware of the power they have through their actions to influence the future of the collection system maintenance group. We will present the position that NOT keeping the cost of cleaning sewer to a minimum has led to the increased privatizing of sewer cleaning activities across the country. The attendees will receive information on steps that can be taken on how this can be avoided.

Topics covered include:

- How revenue is generated to fund the sewer maintenance program
- How the cost of sewer maintenance is calculated
- Why cities are privatizing
- How can an operator directly affect the reduction of costs?
- Planning and control challenges
- How to develop a cost-effective maintenance program
- When does a pipe need to be cleaned?
- What is a dirty pipe?
- How many minutes days are you cleaning pipe?
- Daily procedures that affect production
- How to improve on each procedure to improve use of time

Check for Understanding:

- Instructor will ask for questions from students.

What can be done to lower costs?

- Increased daily production
- Reduction of equipment downtime
- Improved planning and control

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Element: **Pneumatic Plugs**

Duration: **1 Hour**

Description of Class:

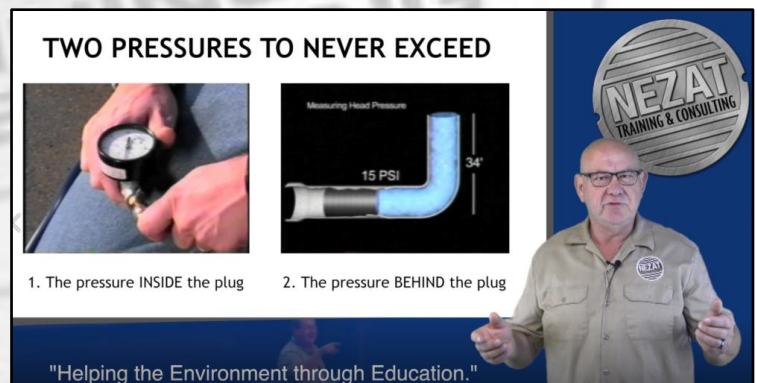
This class will provide instruction in the proper use and maintenance of Pneumatic plugs. There are a variety of plugs currently in use by municipalities around the country. The intent of this class is to provide a working understanding of the dangers involved with their use. Workers are severely injured and even killed by the improper use of these devices. This class will provide information to the end user that will allow them to properly make choices as to the type of plug to be used in various cleaning situations as well as proper installation and removal procedures.

Learning Objectives:

- Students will develop an appreciation of the use and maintenance of pneumatic plugs.
- Students will be exposed to the dangers involved with the use of pneumatic plugs.
- Students will review the use and storage of pneumatic plugs.

Topics covered include:

- What is a plug
- Safety
- The force inside the plug
- The force behind the plug
- Proper inflation hose and gauge
- Installation
- Working around plugs
- Removal
- Maintenance and storage
- Pressure relief regulator
- Securing lines for the plug



Check for Understanding:

- Instructor will break for questions and to ask for example of misuse of plugs
- Students will take Quiz One: Plugs

Element: **Use and Maintenance of High-Pressure Sewer Hose**

Duration: **1 Hour**

Description of Class:

This class will provide an overview of the major aspects of high-pressure sewer hose employed on sewer jetting equipment. Attendees will be instructed in the proper use, maintenance, protection, and repair of all manufactured hose currently on the market. They will be informed of the color-coding system currently in use that identifies each manufacturer's hose. This is very important when splicing of hose is performed. Not understanding the coding system has led to injuries and deaths due to hose splice failures.

Learning Objectives:

- Students will learn the importance of the coding system for high pressure sewer hose used in the industry.
- Students will be taught how to properly splice hose and protect it.
- Students will be instructed in proper use and storage of high-pressure sewer hose.

Topics covered include:

- The anatomy of the hose
- Safety
- Color coding
- Hose protection
- Hose splicing procedures
- Splicing tools
- Coding of splices
- Installing new hose



Check for Understanding:

- Ask students to provide examples of what they have seen or done that was correct and what they have seen done that was incorrect, based on this training.
- Instructor will review content to be assessed on the quiz
- Students will take Quiz Two: Hose

Element: **Nozzles**

Duration: **1 Hour**

Description of Class:

This class will overview all major aspects of nozzles including selection, orifices, maintenance, and proper use. The attendees will view video of various nozzles in use during the cleaning process. Research performed on the various aspects of nozzles will be presented that will challenge the attendees view of the functionality of the current nozzles on the market. They will be equipped to make better choices as to which nozzle to use in various applications and proper techniques for their use.

Learning Objectives:

- Students will be taught proper functions of nozzle and best practices for operation.
- Students understand the importance of orifices in cleaning process.
- Students will be equipped to make better choices as to which nozzle to use in various applications and/or situations.

Topics covered include:

- Safety
- What is a nozzle?
- How is pressure generated?
- How do nozzles clean pipe
- Changes in pressure
- Angle of jets
- Action of high velocity water
- Flow and turbulence
- Understanding pressures and velocity relationships
- Orifices
- Inlet vs Outlet opening
- Nozzle carrying capacity's
- Choosing the right nozzle for the job
- Nozzle characteristics
- Nozzle extensions

The slide features a title 'SEWER WORKER KILLED BY NOZZLE' at the top. Below the title is a paragraph of text describing an incident on August 6, 1999, where a 29-year-old male public works employee died. The text explains that two employees were performing routine cleaning of a sanitary sewer line using a high-pressure water hose. One employee was struck in the head by the nozzle of the hose, which had come back up through the manhole. The victim was not in sight due to a ravine and landscape between the two positions. The co-worker stated that as the sewer cleaning was in process, he heard the nozzle approaching his end of the sewer line, indicating there were no obstructions in the line, and radioed the victim. The victim started reeling the hose back to the truck. The co-worker heard the truck idle down and knew that the hose was back at the start of the sewer line. To the right of the text is a photograph showing a worker in a yellow safety vest and hard hat near a sewer cleaning truck. In the bottom right corner of the slide is a circular logo for 'NEZAT TRAINING & CONSULTING' with a man in a tan shirt standing in front of it.

Check for Understanding:

- Instructor will ask students to group and discuss the process for choosing the right nozzle.

Element: **Nozzles Continued: High Pressure Water Systems**

Duration: **30 Min.**

Description of Class:

This class will explain the mechanical workings of high-pressure water pumps that are utilized on various combination sewer cleaning units. The class will address basic mechanical principles and the physics rules involved in how these systems operate along with their associated components within the entire high pressure water system.

Learning Objectives:

- Students will be taught proper operation and maintenance of the components of a high-pressure water system.
- Students will acquire troubleshooting skills related to low-pressure issues of a high-pressure water system.
- Students will be taught the characteristics of a high-pressure nozzle.

Topics covered include:

- Mechanical workings of a pump
- Triplex pumps
- Quadruplex pumps
- Single piston double action pumps
- Mechanically driven pumps
- Hydraulically driven pumps
- Review all components and their functions within the high-pressure water system
- How high-water pressure is created
- Troubleshooting and identifying low pressure issues
- Required system maintenance procedures

Check for Understanding:

- Instructor will ask for real-world examples from the workers' own experiences.

NOZZLES

WHAT IS OUR WATER SOURCE?

A Triplex/Vactor pump delivers a constant flow of water to the nozzle at a rate of 65 to 80 GPM depending on the pump's rating.

3-5

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Element: **Nozzles Continued: Capacity Cleaning**

Duration: **30 Min.**

Description of Class:

Through our research we have been able to determine that nozzles have the capacity to carry a certain amount of material as they travel through the pipe. Understanding these carrying capacities and adjusting the cleaning technique to this understanding has led to as much as a 75% reduction in cleaning time.

Learning Objectives:

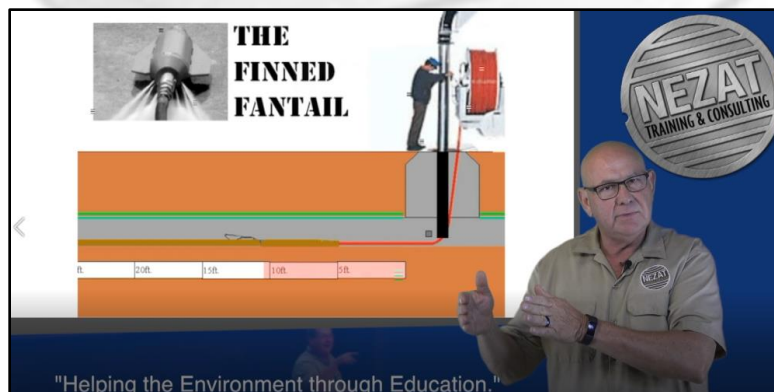
- Students will gain knowledge that will lead to increases in daily production rates.
- Students will realize increases in the quality of their pipe cleaning abilities.

Topics covered include:

- What is Nozzle Capacity Cleaning?
- How long should the steps be?
- How many steps should you take?
- Nozzle Capacity Cleaning Matrix
- How to determine how dirty is a pipe
- Debris chart
- When is the pipe clean?
- Steps to long
- Reverse cleaning
- Why is Nozzle Capacity Cleaning the most effective way to clean pipe

Check for Understanding:

- Instructor will assess prior knowledge by asking about a) Appropriate step cleaning length and b) how to determine step capacity length.
- Students will take Quiz Three: Nozzles



Element: **Dynamic Filling**

Duration: **30 Min.**

Description of Class:

Through our research we have been able to determine that nozzles have the capacity to carry a certain amount of material as they travel through the pipe. Understanding these carrying capacities and adjusting the cleaning technique to this understanding has led to as much as a 75% reduction in cleaning time.

Learning Objectives:

- Students will understand the process and equipment requirements associated in preparing and installing a dynamic filling system in the field.
- Students will realize increases in the increase in production by utilizing dynamic filling.
- Students will understand the safety precautions that must be taken for dynamic filling process in the field.

Topics covered include:

- How much time is spent cleaning pipe a day?
- Three ways to increase cleaning time
- When do we use dynamic filling?
- Benefits of dynamic filling
- Equipment required
- Best practices
- Increasing production with dynamic filling

Check for Understanding:

- Instructor will ask students form small groups and discuss content presented.
- Students will take Quiz Four: Dynamic Filling

The image shows a presentation slide titled "DYNAMIC FILLING". The slide content includes:

- DYNAMIC FILLING**
- WHEN DO WE USE DYNAMIC FILLING?**
Dynamic filling is used whenever one tank of water is not sufficient to clean the line and a fire hydrant is within 300 ft. of the unit.
- BENEFITS OF DYNAMIC FILLING**
 - Reduces the number of setups on a single manhole
 - Increases production
 - Improves the quality of cleaning
 - Makes vacuum tank available for debris instead of potable water

There are two small images: one of a yellow nozzle and one of a vacuum truck. A speaker, Malvin A. Nezat, is visible in the bottom right corner of the slide frame. The slide also features the "NEZAT TRAINING & CONSULTING" logo and the slogan "Helping the Environment through Education." at the bottom.

Element: **Blockage Removal of Roots and Grease**

Duration: **1 Hour**

Description of Class:

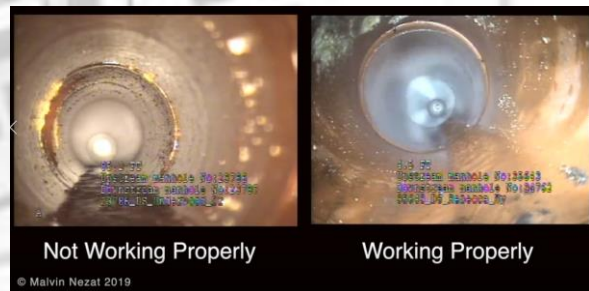
This class will explore the most common types of blockages that form over time in sanitary sewer lines. Attendees will learn about a variety of tools available and the best method for using them safely to completely remove a blockage in the shortest amount of time.

Learning Objectives:

- Students will learn about the formation and prevention of blockages.
- Students will acquire techniques that will allow for quicker blockage removal.
- Students will gain an understanding of tools designed for root and grease removal.

Topics covered include:

- What is grease?
- Why is grease a problem?
- What does grease look like?
- Best method for removing grease
- Force behind a blockage
- Mechanical cutter or spinning nozzle
- How are blockages formed?
- How long does this process take?
- Centrifugal cutters
- Hydraulic cutter
- Spinning nozzles
- How do roots grow in sewer pipe?
- How do we remove roots?
- What do roots look like?
- Maintenance practices that influence root growth in sewer
- Why are roots a problem?
- Grease removal matrix using a spinning nozzle
- Grease removal procedure
- Root removal procedure
- What happens once the roots are cut?
- Understanding the functionality of tools designed for root and grease removal



Check for Understanding:

- Instructor will check for previous understanding by asking students to list the types of materials that give them the most problems in the field.
- Students will take Quiz Five: Roots and Blockages

Element: **Vacuum System**

Duration: **1 Hour**

Description of Class:

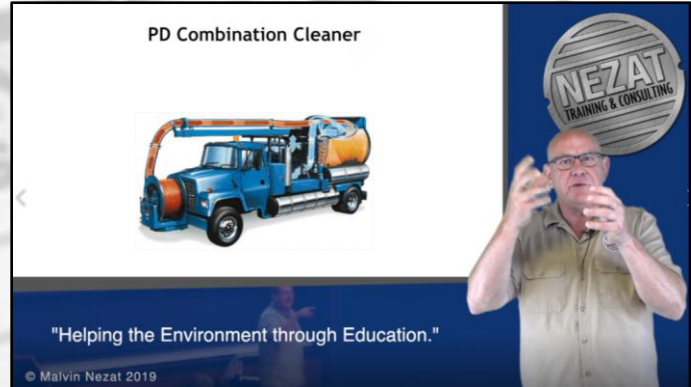
This class will explain the physics principles involved in use of the vacuum system and all the components within the vacuum system of a combination sewer cleaning unit. Principles and methodologies involved the removal of debris under water and at great depths (the process of fluidizing) are explained. Fluidizing allows for the removal of material underneath the water without having to continuously bring the suction tube up for air. Supercharging the vacuum system will be demonstrated. This procedure assists in creating as much air flow as possible thus reducing the amount of time needed for cleaning of wet wells and other structures.

Learning Objectives:

- Students will learn the theories of vacuum, lift, and air movement.
- Students will be taught the various configurations of a vacuum system (PD and Fan.)
- Students will learn about fluidizing and the process of liquefaction of a solid.

Topics covered include:

- Theory of vacuum
- What is air?
- Air movement
- Theory of lift
- Components of the vacuum system
- Positive displacement pumps (PD)
- Centrifugal compressors (Fan)
- Air flow pattern within the system
- Air filtration
- Limitations of different air moving designs
- Supercharging the vacuum system
- Wet well cleaning
- Modification of suction tubes
- Understanding how to maximize air flow
- Fluidizing
- Trouble shooting low vacuum issues



Check for Understanding:

- Students will provide examples of positive and negative experiences with vacuums in the field.
- Students will take Quiz Six: Vacuums

Element: **Decanting**

Duration: **1 Hour**

Description of Class:

Decanting the combination cleaning truck is the final step in completing the sewer cleaning process. While there are many variables in the manufacturing of combination cleaning trucks, this module reviews the basic steps involved in decanting the truck of its collected debris. Several different types of pumps, hoses and procedures are discussed and reviewed. This module also illustrates the usage of dynamic filling combined with decanting to provide the most efficient method of sewer cleaning, where applicable.

Learning Objectives:

- Students will understand the process and equipment requirements associated with decanting combination cleaning trucks.
- Students will realize increases in production by utilizing dynamic filling along with decanting when applicable.
- Students will understand the safety precautions that must be taken when performing the decanting process in the field.

Topics covered include:

- Purpose and benefits of decanting
- Review of decanting-related combination machine components
- Review of different ways to decant the combination machine
- Review the different positioning of decant pumps
- Steps of the decanting process
- Review of types of pumps, discharge hoses and piping used in decanting
- Dumping the truck

Check for Understanding:

- Instructor will ask students form small groups and discuss content presented.
- Students will take Quiz Seven: Decanting

