

SAFETY AT WORK MANAGEMENT DURING NO-DIG TECHNOLOGIES APPLICATION

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25th May 2023

EURSAFE

constituted as a "Research organization" as defined by the Communication of the European Commission 2006 / C 323/01 of 30/12/2006, began as a meeting point of research on the topic of prevention and safety in life, work, and study places. Major topics up now are Safety at work, Confined Spaces safety, Asbestos risk assessment, Pressure vessel management, Drive Safety, Behavioral Safety, Fire prevention - Normobaric Hypoxic atmospheres, NSI - Needles and Sharp surgical devices Incident prevention, and more.

We operate with some agreements with Universities and Public / Private Organizations, and we are:

- *member of UNI Italian national standardization body*
- *member of EUROSAFE European Association for Injury Prevention and Safety Promotion*

CRIS

consolidates the interdisciplinary experiences gained through the research activities and services carried out within the University of Modena and Reggio Emilia since 2007, thanks to the internal resources provided by university professors and researchers and with the support of nationally renowned professionals, each specialist in the specific sector of activity. Security is placed about risks of a different nature: criminal, logical, and physical, or linked to the workplace. For years CRIS, through its numerous thematic research laboratories contextualized within the project "Safety at Work in Practice in Modena", has been a national point of reference to which various other research communities are orienting themselves to establish a community of practice that intends to give concrete answers to the requests for simplicity and effectiveness that the social partners, starting from the workers to get to the companies, need to allow productivity and safety to be combined.

No-dig technologies, or **Trenchless technologies**, are certainly among the **most effective technologies** as they allow a low environmental impact and, at the same time, a significant reduction in the social/environmental costs of pipe rehabilitation works.

However, in preventing and protecting workers' health and safety, it is necessary to conduct a **deep investigation** into some issues that, depending on construction sites' organizational arrangements, as **represented by the photographs and videos** disseminated for promotional purposes, **appear improvable**.

In particular, in addition to standard prevention measures that must necessarily be adopted regarding road construction site establishment, two main issues deserve particular attention:

- **Confined Spaces activities safety legislation application**
- **Asbestos-Cement (AC) existing pipes-related activities**

Confined Spaces activities safety legislation application

Generally, pipe restoration requires the team to have access to both sides of the damaged pipe. A liner is inserted, through existing access points (manholes), for all the length of the pipe from the upstream point and to the endpoint.

Typical access points include:

- a) Maintenance holes, outfalls, vaults, spool ends, basins, and cleanouts
- b) If there aren't external access points, the restoration team can excavate one or both ends of the damaged pipe and remove valves or spool pieces.

Confined Spaces activities safety legislation application

In the case of a), accessing the Confined Spaces activity is identified.

In the case of b), is necessary to clarify if the excavation done is classifiable as Confined Space.

Excavation, generally, is definable as any means any man-made cut, cavity, trench, or depression in an earth's surface, formed by earth removal. By definition, any excavation more than 1.22m (4 ft) deep should be looked at as a Confined Space

Normally, CIPP lining activities take place in trenches that are specific types of excavations in which the depth exceeds (is bigger than) the width (*OSHA defines that the trench width measured at the bottom is not greater than 4.6m -15 ft*). In other words, all trenches are excavations, however, not all excavations are trenches.

Confined Spaces activities safety legislation application

Excavation and trenching are dangerous operations that can include:

cave-ins, falling loads, hazardous atmospheres (*high concentrations of gaseous hazardous chemicals, explosive gases, and poisonous substances*), and hazards from using heavy equipment.

Additional risk factors are due to:

limited dimensions and means of entry/exit for rescue operations in case of emergency, unstable conditions of the walls, and the consequent probability of landslides, sharp rise in groundwater, and displacement of the protections, a limited amount of time available for emergency and other urgent interventions.

Confined Spaces activities safety legislation application

Confined Space Standard Subpart AA 1926.1201(b)(1) states that this standard does not apply to construction work regulated by 1926 Subpart P—Excavations, but works can shift to the regulations of 1926.1200 Subpart AA in an excavation or trench environment when **workers must enter** structures like precast pipe, manholes, and vaults or other similar configurations that meet the Confined Space definition:

1. is large enough and so configured that an employee can bodily enter it;
2. has limited or restricted means for entry and exit; and
3. is not designed for continuous employee occupancy

Confined Spaces activities safety legislation application

For CIPP, for example, entered upstream and downstream manholes to manually cut away excess sections of cured liner or come through host pipe to open laterals after relining (when remote cut method by using hydraulically powered robotic cutter specifically designed for this purpose it's not possible or the host pipe diameter is greater enough), are certainly Confined Spaces activities under 1926.1200 Subpart AA that must be applied to non-excavation work within a Confined Space located in an excavation.

Confined Spaces activities safety legislation application

If we look at the Italian National laws regarding workplaces that could be considered analogous to Confined Spaces (Ministero del Lavoro e delle Politiche Sociali, 2011), we found that “trenches” (a general definition that, unlike what is present in the US legislation, don’t give precise numerical indications that allow discriminating whether excavation is a trench or when could become a confined space) are included in the list among the places for which companies that carry out activities inside them, must possess specific qualifications requirements.

Confined Spaces activities safety legislation application

Somebody might think that an excavation or trench in the ground *isn't a Confined Space*, but that would be an incorrect assumption considering that these spaces *could meet* the criteria for limited entry and exit, space, and habitation and, in addition, in the excavated area there are some risks to be taken into account.

In fact, beyond the definition, the *most important thing is to identify hazards present* or that *could arise during the work* and carry out an *adequate risk assessment* to identify the necessary *prevention and protection measures* to be adopted for *workers' safety protection*.

Confined Spaces activities safety legislation application

In CIPP project, engineers must consider entering confined spaces, such as manholes or inspection hatches, to perform:

- inspections,
- cleaning operations,
- liner insert,
- place thermocouples before curing,
- cutting the excess liner,
- protruding service lateral connections (*when remote cut method by using hydraulically powered robotic cutter specifically designed for this purpose it's not possible*).

In these cases, according with safety regulations, must be performed the evaluation of the atmosphere to determine the presence of toxic gasses, flammable vapors or lack of oxygen.

Confined Spaces activities safety legislation application

Another important topic that must be considered, depending on the work being done, is to evaluate if Confined Space Rescue Team (CSRT) may be necessary.

Rescue operations in Confined Spaces, are **high-risk activities** that require **trained personnel and specialized equipment**.

When dealing with Confined Spaces involving CIPP lining, the need for a company CSRT with proper rescue equipment and knowledge about rescue methods can address operations to save victims from emergencies.

Depending on the kind of work that must be performed and the worksite characteristics, the necessity of CSRT **on-site** or **on standby** must be assessed.

To perform the best rescue if someone becomes injured, incapacitated, or trapped in a space and has to be rescued, all rescuers must be fully briefed on their assignments, formulated rescue plan emergency procedures have to be established and understood by all.

Asbestos-Cement (AC) existing pipes-related activities

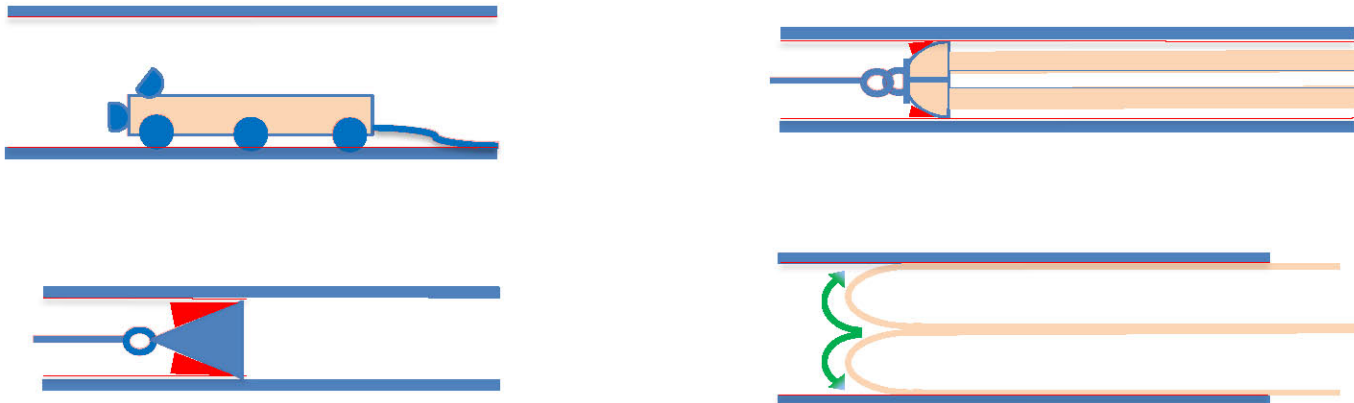
Products containing asbestos are also known as asbestos-containing materials (MCA). Across Europe, Australia and Japan AC pipes are present in water distribution networks (*approximately 12-15% of the total length of water distribution system piping in North America or 25% of the total Netherlands water distribution network, etc.*)

In Italy, asbestos fibers were found in about 300,000 km of water distribution pipes (Osservatorio Nazionale Amianto, 2023).

The asbestos release from AC pipes is possible when one or more of the cement constituents are dissolved and chemically inert asbestos fibers lose their mechanical support. The asbestos fibers are being released from deteriorated pipes even more abundantly when subjected to vibrations such as road proximity, railroads, construction works, earthquakes, water flows, etc.

Asbestos-Cement (AC) existing pipes-related activities

CIPP operations can produce materials contaminated with asbestos fibers, and equipment surfaces can be also contaminated with asbestos fibers.



The slurry of cleaning water discharged during the cleaning operations and the material that has been brushed and brought outside the pipe (*due to rubbing against the internal surface of the AC pipes that, after a long time of service, could be deteriorated*) can contain a high concentration of asbestos fibers that had to be assessed and appropriately disposed of.

Asbestos-Cement (AC) existing pipes-related activities

Normally, materials that come out from the pipe to be renewed are wet and look like mud, however, particular caution must be taken to avoid any contact with the skin and to not inhale asbestos fibers.

These materials can dry on workers' clothes, the ground, and the equipment used, all of which must be thoroughly cleaned before work is shut down.

Furthermore, when an item contacts the asbestos-containing mud, it becomes a potential source of future asbestos fiber release if and when the mud dries, adding later decontamination measures that increase the potential for asbestos exposure.

Workers must wear disposable coveralls, gloves, and respiratory PPE that must be disposed of as MCA, and equipment must clean adopting specific decontamination measures.

Asbestos-Cement (AC) existing pipes-related activities

Dispersion into the soil both materials, that have been brushed and brought outside the pipe, and water-cleaned drain must be avoided.

Dispersing water on impermeable paving (e.g. asphalt, cement, etc.) is forbidden as it could dry off and lead to the dispersion of fibers into the atmosphere. Discharge in the sewer of this water, and water coming from equipment cleaning that might contain asbestos fibers, could normally be admitted only after filtration.

It is recommended to lay a high-density polyethylene sheet at least 0.15 mm thick, or an equivalent “geotextile non-woven fabric” sheet, to avoid fibers dispersion into the soil.

Mud, waste materials coming from decontamination activities, worker’s worn disposables, and the filtrate (filter included), must be placed in containment, entrusted to specialized companies in possession of the by-law required requisites, and disposed of according to current laws.

Asbestos-Cement (AC) existing pipes-related activities

All of this being said, referring to the applicable specific legislation, it's necessary to define if these activities should be assimilated to materials containing asbestos removal activities.

This is because is known that any activities regarding asbestos removal (activities that produce waste materials to be disposed of as asbestos-contained materials) must be carried out by specialized companies with specific requirements and that employ workers with a specific license as operators in charge of asbestos, that are subject to regular health surveillance by the physician.

In any case, asbestos exposure risk must be carefully assessed, and performed activities must be compliant with current laws.

Conclusions

We have identified some critical contextual factor that shapes key mechanisms that, in our opinion, are related to Cured-In-Place Pipe (CIPP) activities:

- Confined Spaces activities in trenches;
- Asbestos Cement (AC) pipes relining.

Personnel from trenchless technology firms should deeply analyze these topics, for guaranteeing the safety of the operators, as well as identifying the methods by which to manage the phases of a possible emergency for the rescue of an injured or taken ill worker. Also, a chemical risk assessment must be performed.

Further research, would be very useful to capture the experiences and perspectives of the company that works in the CIPP relining field, asking them to voluntarily participate in studies on the general theme of safety workplace during CIPP activities. Including realist tests about normal and emergency operating procedures, might be possible to improve and extend general knowledge on the topics that we have discussed.

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THANK YOU FOR YOUR KIND ATTENTION!

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