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TECHNICAL NOTE

Use of halogen-free cables and electrical wires at European XFEL

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Revisions

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Contents

1 Background

Many kilometres of cable and electrical wire have been installed at European XFEL. To achieve the highest safety standards, these installations have taken place observing the plan approval order, national safety regulations, and internal safety regulations of DESY (e.g. cable specification of DESY).

Accordingly, insulation materials were chosen that are halogen-free; those containing polyvinylchloride (PVC) were avoided. PVC is especially hazardous in the case of fire, as it has a caustic effect on the eyes and lungs. Additionally, the smoke from burning PVC is extremely thick (eight times thicker than that from halogen-free cables) with soot and aerosols containing hydrochlorid acid (HCl). Smoke density is decisive in how fast people are able to escape from a building and how successful the rescue and firefighting actions will be. The acidic vapors generated also corrode metals and damage building walls. Other research facilities running underground accelerators (e.g. CERN and DESY) have experienced a number of fires in which severe damage was caused, particularly by the HCl resulting from PVC insulating cables. As accelerator facilities have become longer, personnel may be exposed to smoke from fire for considerably longer periods than in surface installations. Therefore, an effort must be made to use materials that do not burn easily and that evolve smoke of low optical density, low corrosiveness, and low toxicity.

2 Current situation

In 2017, the operation phase begins at European XFEL. In order to power equipment and test devices, extension and patch cables (ranging from 1–20 m) will be brought into the tunnels or the experiment hall. This could include 230 V power extension cables, 230 V power distribution strips, patch cables, data patch cables, signal cables, etc. These cables will not be enclosed when installed and will remain in the experiment rooms for long periods. Accordingly, this could result in hundreds of metres of cable insulation per experiment (10 m of cable contain about 1.8 kg of PVC).

So far, the European XFEL IT and Data Management (ITDM) group has made sure that patch cables in all underground areas of the facility are halogen-free. Power cables delivered with equipment have also been replaced by halogen-free cables.

We strongly recommend that a safety policy be introduced to prevent the use of PVC in insulations in the tunnels, experiment hall, and laboratory rooms and corridors.

It would also be sensible to address the risks due to the use of cables with PVC insulation in the office areas.

3 Solution

To prevent the use of PVC in insulations in the tunnels, experiment hall, and laboratory rooms and corridors, we recommend the following:

- **Awareness**
  Create awareness and clarification among staff members of the issue with insulation cables containing PVC. This is presently done by the Safety and Radiation Protection (SRP) group when consulted in this matter and is also part of the general safety training. A dedicated safety policy would provide a better foundation.
- **Stock**
  Stock standard halogen-free (10–20 types): power cords 1.5 and 3 m long; five power strips with 2 m cables; nine power strips with 2m cables; 10 m extension cables; 25 m cable reels (USB A→B und A→Micro); 0.3 m, 1 m, and 2 m BNC signal cables; 0.3 m, 1 m, and 2 m LEMO signal cables; and 2 m SHV cables. This would cover 95% of the requirements.
- **Vendors**
  Create a list of producers and vendors of halogen-free cables, for use in specific cases.
- **Exemption**s
  Allow exemptions for special cables in which halogen-free insulations (e.g. the test probes of oscilloscopes) cannot be obtained.

Given that users will bring cables to the facility, it will be necessary to publish the policy.

4 Costs

Example of past material costs:

In summer 2014, the Vacuum group at European XFEL purchased 100 halogen-free power cords at a price of € 350.

Future costs:

- Personnel costs to clarify and raise awareness:
  5 hours/year for one FTE from the SRP group
- Personnel costs to cover the ordering and stocking of standard halogen-free cables:
  ca. 2 hours/month (Procurement group)
- Stocking costs:
  Room plus related capital of around € 8000 (16 items at € 500 each)

We will save personnel costs, as individual clarification will no longer be needed. We will also save the time and material costs incurred in ordering single items.

5 Summary

To increase the level the safety at European XFEL, use of halogen-free cables should be prescribed in internal safety regulations, as is done at CERN and DESY.

For further information about this policy, contact any of the following European XFEL staff members:

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