

# Q&A

## Halogen Free Printed Circuit Substrates Q&A

### What defines a halogenated compound?

Halogenated compounds are those formed in conjunction with negatively charged halide ions, and are created with the elements found in Group VIIA of the [periodic table](#). [hosted by Los Alamos National Laboratory] The subset of these elements that are normally found in laminate includes bromine (Br), chlorine (Cl), and Fluorine (F).

### Which specific halogenated compounds are relevant to halogen free and bromine free discussions, and why are they a concern?

Bromine is the specific halogen most often cited. Compounds relevant to this discussion include:

- |   |                 |
|---|-----------------|
| • Polybrominated biphenyls (PBB)                | CAS# 13654-09-6 |
| • Pentabromodiphenyls, specifically "penta-BDE" | CAS# 32534-81-9 |
| • Octabromodiphenyl, specifically "octa-BDE"    | CAS# 32536-52-0 |
| • Decabromodiphenyl, specifically "deca-BDE"    | CAS# 1163-19-5  |
| • Tetrabromobisphenol-A (TBBA)                  | CAS# 79-94-7    |

Polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE), which include the above penta-, octa-, and deca-brominated compounds, can react to form dioxins and furans during combustion.

Tetrabromobisphenol-A (TBBA) has been found unlikely to react in this manner, as described in the following summary, from a study by Bayer AG:

- TBBA, its derivatives and the plastics flame retarded with TBBA do not contain significant amounts of furans or dioxins.
- Neither worst case processing nor incineration was shown to produce dioxins or furans above the ppb [parts per billion] range.

### Which of these compounds can be found in Nelco laminates?

Of the above list, only tetrabromobisphenol-A (TBBA) can be found in Nelco laminate. It is in use as a flame retardant for our standard thermosetting FR4 (N4000-##). TBBA is not present in Environmentally Friendly® laminates, which are designed to be halogen free. Elemental chlorine, which is a byproduct of resin manufacture, is present in quantities less than 900ppm in thermosetting resins. Fluorine is not present in detectable quantities in thermosetting resin.

There are no PBBs or PBDEs present in Nelco N4000-## laminates.

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**I have heard that there is a WEEE regulation affecting bromine. What does it say?**

The [WEEE](#) (Waste Electrical and Electronic Equipment) and [RoHS](#) (Restriction of Hazardous Substances) of the European Union both make mention of PBBs and PBDEs. The RoHS has them targeted for elimination by July of 2006. TBBA is under review by the WEEE, but only PBBs and PBDEs have restrictions pending.

**Why has Nelco introduced Environmentally Friendly® laminates without TBBA as a flame retardant if it is not restricted by the EU documents and was not found to be a significant threat in the Bayer AG study?**

The desire to eliminate PBB and PBDE has been simplified in many initiatives to include not only all brominated compounds, but all halogens. The reasons are varied, but clearly this leaves our customers who are affected by such requirements with a need for halogen free laminates. To learn more, please see contact your local Nelco representative.

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