

**M E M O R A N D U M**

*To:* GLIMOS for LHC and non-LHC Experiments  
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***Subject:* Safety considerations for the purchase of Printed Circuit Boards<sup>1</sup>**

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Printed Circuit Boards (PCBs) were, until some years ago, manufactured exclusively from so-called FR-4 materials. These materials contain brominated (halogenated) fire-retardants and are, as such, prohibited for use in certain areas at CERN<sup>2</sup>, particularly in experimental and underground areas, providing that alternative materials exist, which conform to CERN Rules.

Alternative materials have now been available on the market for several years. These materials exhibit the appropriate, and sometimes superior, mechanical and electrical properties required<sup>3</sup>. They are free of bromine and other halogens and have been shown to have acceptable fire behaviour properties (e.g. low smoke density and low corrosivity of combustion gases), which is not the case for the standard FR-4 materials. There were concerns for the availability of the alternative materials and their long term ageing characteristics. A list of suppliers of PCBs and their base materials, valid as of 2002, is attached to this memorandum.

Therefore, in all relevant market surveys explicit reference shall be made to the fact that CERN's safety rules prohibit the use of halogenated material. Already at the Market Survey stage, vendors shall be requested whether or not they can supply products compliant with CERN's safety rules. The related calls-for-tender shall exclusively ask for a quote for halogen-free material, unless the market survey had already demonstrated that a competitive tender is no longer guaranteed in terms of a too small number of responding companies, or unless it has been established that no halogen free products are available.

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<sup>1</sup> To be used inside commercial products such as personal computers or as a stand alone product for electronics application.

<sup>2</sup> Safety Instruction IS41: The use of plastic and other non-metallic materials at CERN with respect to fire safety and radiation resistance

<sup>3</sup> Alternative materials: e.g. (i) Annex 1; (ii) Minutes of the Working Group for replacement of FR-4 materials as of 31 Jan. 2002; (iii) J. Svantesson, Complex dielectric constant of non-halogenated replacement materials for FR4 plastics used for the manufacture of printed circuit boards, CERN-TIS-2002-02-GS-IR, EDMS 356498.

**ANNEX 1: List of suppliers of non-halogenated replacement material for FR4 Printed Circuit Boards**

| Suppliers of base materials | Contact   | Address  | Country | Phone / Fax                               | Product(s)                                       |
|-----------------------------|---|--|---------|---|--|
| HITACHI                     | Mr J-L. Brouillat<br>JLBrouillat@compuserve.com | 72, rue du Cherche-Midi<br>75 006 - PARIS      | Fr      | + 33 1 45 49 44 18<br>+ 33 1 45 48 38 87  | MCL-RO-67G                                       |
| ISOLA                       | Dr M. Cygon<br>m.cygon@isola.de                 | Isolastrasse, 2<br>52 353 - Duren              | De      | + 49 24 21 808 670<br>+ 49 24 21 808 8670 | Duraver E-CU 150 (FR5)<br>Duraver E-CU 156 (FR4) |
| ISOVOLTA                    | Dr J. Oberlehner<br>Oberlehner.j@isovolta.com   | Isovoltastrasse<br>2355 - Wiener Neudorf       | At      | + 43 2236 605 406<br>+ 43 2236 605 477    | Isopreg FR 1179/G-11<br>Isoval FR5-HF            |
| PARK-NELCO                  | smecracken@parknelco.com                        | 1 Paddock Rd., West Pimbo<br>Skelmerdale,      | UK      | + 44 1695 22691                           | N4000-2 EF                                       |
| Nelco/Dielektra             |   | Lancashire, WN8 9PL                            |         | + 44 1695 721082                          | ( N4000-6 EF and 13EF )                          |
| POLYCLAD                    | Mr G. Guillamin<br>gguillamin@polyclad-eur.com  | 12, rue de la Garde<br>44 335 - Nantes Cedex 3 | Fr      | + 33 2 40 68 21 21<br>+ 33 2 40 93 20 75  | ~FR4 under development<br>+ polyimide            |
| RESARM                      | Mr R. Gaillard                                  | ZI, rue Pres-Champs, 21<br>4671 - Barchon      | Be      | + 32 4 387 91 91<br>+ 32 4 387 44 11      | Permaglass TE 630                                |
| THERMAGON                   | Mr Paul J. Klouda<br>klouda@thermagon.com       | 3256 W. 25th Street<br>Cleveland, Ohio 44109   | USA     | + 001 216 741 7659<br>+ 001 216 741 3943  | T-preg 1 KA                                      |
| TOSHIBA                     | Mr N. Honda<br>tcc-05@qa2.so-net.or.jp          | 5-14-25 Ryoke, Kawaguchi-City<br>Saitama 332   | Jp      | + 81 48 225 8122<br>+ 81 48 225 0085      | no name ? (~FR-4)                                |

| Suppliers of PCBs        | contact  | Address   | Country | Phone / Fax                              | Product(s)   |
|--------------------------|--|---|---------|--|--|
| AC Plus                  | jriborra@acplus.fr                               | ZI le Pre du Roy<br>07 100 - St Marcelles-<br>Annonay                         | Fr      | + 33 4 75 67 10 25<br>+ 33 4 75 67 14 71 | ( Duraver E-CU 150 (FR5) )<br>Duraver E-CU 156 (FR4) |
| ASTRON<br>Kamtronics Ltd | Mr. Howard Goff<br>howard@kam.com                | Pacific House, Beverbook<br>Center, Redman Road,<br>Calne, Wihahire, SN11 9PR | UK      | + 44 1249 815 262<br>+ 44 1249 821 286   |  |
| CISTELAIER               | Mr P. Tibaldi                                    | via Gandhi, 1<br>41 100 - Modena  | It      | + 39 59 26 97 ?1<br>+ 39 59 25 01 65     | ( Duraver E-CU 150 (FR5) )<br>Duraver E-CU 156 (FR4) |
| KAPI                     | Mr C. Pirotte<br>Christian.Pirotte@cern.ch       | rue des Technologies, 10<br>4530 - Villers-le-Bouillet                        | Be      |  | ( Duraver E-CU 150 (FR5) )<br>Duraver E-CU 156 (FR4) |
| MULTEK                   | Mrs S. Ehrler, Hr K. Binder<br>kbinder@multek.de | Herrenberger Strasse 110<br>71034 Boeblingen                                  | De      | + 49 7031 2113400                        | the 4 hal-free laminates                             |
| PPC Electronic           | Mr M. Bucher<br>max.bucher@ppc-<br>electronic.ch | Riedstrasse, 2<br><br>6330 - Cham   | CH      | 041 749 45 45<br><br>041 749 45 00       | Duraver E-CU 156 (FR4)<br><br>T-preg                 |
| SIEMENS                  | Mr L. Bornemisza                                 | av. Des Baumettes, 5<br>1020 - Renens   | CH      | 021 631 81 52<br>021 631 83 29           | ( Duraver E-CU 150 (FR5) )<br>Duraver E-CU 156 (FR4) |