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*Les Diablerets, Switzerland
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APPENDIX B

MAJOR ACRONYMS AND ABBREVIATIONS

| | |
|---------|---|
| AASE | Airborne Arctic Stratospheric Expedition |
| ADEOS | Advanced Earth Observing Satellite |
| AER | Atmospheric and Environmental Research, Inc. (United States) |
| AFEAS | Alternative Fluorocarbons Environmental Acceptability Study |
| AGAGE | Advanced Global Atmospheric Gases Experiment |
| AI | aerosol index |
| ALE | Atmospheric Lifetime Experiment |
| AO | Arctic Oscillation |
| AOD | aerosol optical depth |
| ATMOS | Atmospheric Trace Molecule Spectroscopy |
| AVHRR | Advanced Very High Resolution Radiometer |
| AWI | Alfred Wegener Institute (Germany) |
| | |
| BDC | Brewer-Dobson circulation |
| BL | boundary layer |
| BUV | Backscatter Ultraviolet (spectrometer) |
| | |
| CARIBIC | Civil Aircraft for Regular Investigation of the Atmosphere Based on an Instrument Container |
| CARMA | Community Aerosol and Radiation Model for Atmospheres |
| CCSR | Center for Climate System Research (University of Tokyo) |
| CFC | chlorofluorocarbon |
| CICERO | Centre for International Climate and Environmental Research, Universitetet I Oslo (Norway) |
| CIE | Commission Internationale de l'Éclairage (France) |
| CIRES | Cooperative Institute for Research in Environmental Sciences (United States) |
| CLAES | Cryogenic Limb Array Etalon Spectrometer |
| CLAMS | Chemical Lagrangian Model of the Stratosphere |
| CMAM | Canadian Middle Atmosphere Model |
| CMDL | Climate Monitoring and Diagnostics Laboratory (NOAA) |
| CNR-IFA | Consiglio Nazionale della Ricerca-Istituto di Fisica dell'Atmosfera (Italy) |
| CNRM | Centre National de Recherches Météorologiques (France) |
| CNRS | Centre National de la Recherche Scientifique (France) |
| CONICET | Consejo de Investigaciones Científicas y Técnicas |
| CPC | Climate Prediction Center (NCEP) |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation (Australia) |
| CTM | chemical transport model |
| | |
| DLR | Deutschen Zentrum für Luft- und Raumfahrt (Germany) |
| DMS | dimethyl sulfide |
| DMSO | dimethyl sulfoxide |
| DOAS | Differential Optical Absorption Spectroscopy |
| DSCD | differential slant column density |
| DSIR | Department of Scientific and Industrial Research (South Africa) |
| DU | Dobson unit |
| | |
| EC | European Commission |
| ECC | electrochemical concentration cell (ozonesonde) |

ACRONYMS

| | |
|----------|---|
| ECD | electron capture detector |
| ECHAM | European Centre Hamburg Model |
| ECMWF | European Centre for Medium-Range Weather Forecasts (United Kingdom) |
| EECI | effective equivalent chlorine |
| EESC | effective equivalent stratospheric chlorine |
| ENSO | El Niño-Southern Oscillation |
| EP | Earth Probe |
| EPA | Environmental Protection Agency (United States) |
| ER-2 | Earth Resources-2 (aircraft) |
| ERBE | Earth Radiation Budget Experiment |
| ERS-2 | European Remote Sensing-2 (satellite) |
| ETH | Eidgenössische Technische Hochschule (Swiss Federal Institute of Technology) (Switzerland) |
| EU | European Union |
| EUVDB | European Ultraviolet Database |
| FC | fluorocarbon |
| FDH | fixed dynamical heating (model) |
| FSSP | forward scattering spectrometer probe |
| FTIR | Fourier transform infrared |
| FUB | Freie Universität Berlin (Germany) |
| GAGE | Global Atmospheric Gases Experiment |
| GAW | Global Atmosphere Watch |
| GCM | general circulation model |
| GC-MS | gas chromatograph-mass spectrometer |
| GFDL | Geophysical Fluid Dynamics Laboratory (NOAA) |
| GHG | greenhouse gas |
| GISS | Goddard Institute for Space Studies (NASA) |
| GOME | Global Ozone Monitoring Experiment |
| GRIPS | GCM-Reality Intercomparison Project for SPARC |
| GSFC | Goddard Space Flight Center (NASA) |
| GWD | gravity wave drag |
| GWP | Global Warming Potential |
| HALOE | Halogen Occultation Experiment |
| HBFC | hydrobromofluorocarbon |
| HC | hydrocarbon |
| HCFC | hydrochlorofluorocarbon |
| HFC | hydrofluorocarbon |
| HFE | hydrofluorinated ether or hydrofluoroether |
| hPa | hectoPascal |
| IASB | Institut d'Aéronomie Spatiale de Belgique (Belgium) |
| IFU | Institute for Atmospheric Environmental Research (Germany) |
| IGAC | International Global Atmospheric Chemistry |
| ILAS | Improved Limb Atmospheric Spectrometer |
| IPCC | Intergovernmental Panel on Climate Change |
| IR | infrared |
| IROE-CNR | Istituto di Ricrea sulle Onde Elettromagnetiche del Consiglio Nazionale della Ricerca (Italy) |
| ISAMS | Improved Stratospheric and Mesospheric Sounder |
| ISCCP | International Satellite Cloud Climatology Project |
| IUPAC | International Union of Pure and Applied Chemistry |

| | |
|--------------|--|
| JMA | Japan Meteorological Agency (Japan) |
| JPL | Jet Propulsion Laboratory (NASA) |
| JRC | Joint Research Centre (Italy) |
| KASIMA | Karlsruhe Simulation Model of the Middle Atmosphere |
| KNMI | Koninklijk Nederlands Meteorologisch Instituut (The Netherlands) |
| LaRC | Langley Research Center (NASA) |
| LCTM | Lagrangian chemical transport model |
| LLNL | Lawrence Livermore National Laboratory (United States) |
| LMS | lowermost stratosphere |
| LS | lower stratosphere |
| M3 | Meteor-3 (satellite) |
| MAECHAM/CHEM | Middle Atmosphere European Centre Hamburg Model with Chemistry |
| MASP | Multiangle Aerosol Spectrometer Probe |
| MATCH | Model of Atmospheric Transport and Chemistry |
| MBL | marine boundary layer |
| MD | mass deficiency |
| MIT | Massachusetts Institute of Technology (United States) |
| MLS | Microwave Limb Sounder |
| MODIS | Moderate Resolution Imaging Spectroradiometer |
| MOZAIC | Measurement of Ozone and Water Vapor by Airbus In-Service Aircraft |
| MOZART2 | Model for Ozone and Related Chemical Tracers, version 2 |
| MPAE | Max-Planck-Institut für Aeronomie (Germany) |
| MPIC | Max-Planck-Institut für Chemie (Germany) |
| MSA | methanesulfonic acid |
| MSC | Meteorological Service of Canada |
| MSU | Microwave Sounding Unit |
| N7 | Nimbus-7 (satellite) |
| NAD | nitric acid dihydrate |
| NAM | NH annular mode |
| NAO | North Atlantic Oscillation |
| NASA | National Aeronautics and Space Administration (United States) |
| NAT | nitric acid trihydrate |
| NCAR | National Center for Atmospheric Research (United States) |
| NCEP | National Centers for Environmental Prediction (NOAA) |
| NDSC | Network for the Detection of Stratospheric Change |
| NH | Northern Hemisphere |
| NIES | National Institute for Environmental Studies (Japan) |
| NIST | National Institute of Standards and Technology (formerly NBS, United States) |
| NIWA | National Institute of Water and Atmospheric Research (New Zealand) |
| NMHC | nonmethane hydrocarbon |
| NOAA | National Oceanic and Atmospheric Administration (United States) |
| n-PB | n-propyl bromide |
| NPL | National Physical Laboratory (United Kingdom) |
| NPLS | nonparametric least-square fits |
| NSF | National Science Foundation (United States) |
| NWP | numerical weather prediction |
| NWS | National Weather Service (NOAA) |

ACRONYMS

| | |
|-------------|---|
| ODP | Ozone Depletion Potential |
| ODS | ozone-depleting substance |
| OGI | Oregon Graduate Institute (United States) |
| OHP | Observatoire de Haute-Provence (France) |
| OMS | Observations of the Middle Stratosphere |
| OPC | optical particle counter |
| PAN | peroxyacetyl nitrate |
| PAUR | Photochemical Activity and Solar Ultraviolet Radiation |
| PEM-Tropics | Pacific Exploratory Mission in the Tropical Pacific |
| PFC | perfluorocarbon |
| PGI | product gas injection |
| POAM | Polar Ozone and Aerosol Measurement |
| POLARIS | Photochemistry of Ozone Loss in the Arctic Region in Summer |
| ppb | parts per billion |
| ppbv | parts per billion by volume |
| ppm | parts per million |
| ppmv | parts per million by volume |
| ppt | parts per trillion |
| pptv | parts per trillion by volume |
| PSC | polar stratospheric cloud |
| PV | potential vorticity |
| PWD | planetary-wave drag |
| QBO | quasi-biennial oscillation |
| RAF | radiation amplification factor |
| RDF | reverse domain filling |
| RIVM | Rijksinstituut voor Volksgezondheid en Milieu (National Institute of Public Health and the Environment) (The Netherlands) |
| rms | root mean square |
| RT | radiative transfer |
| SAD | surface area density |
| SAGE | Stratospheric Aerosol and Gas Experiment |
| SAM | SH annular mode |
| SAM | Stratospheric Aerosol Measurement |
| SAOZ | Système d'Analyse par Observation Zénithale |
| SBDART | Santa Barbara Discrete-ordinate Hemispheric Radiative Transfer |
| SBUV/SBUV2 | Solar Backscatter Ultraviolet (spectrometer) |
| SCD | slant column density |
| SeaWiFS | Sea-viewing Wide Field-of-view Sensor |
| SEFDH | seasonally evolving fixed dynamical heating (model) |
| SGI | source gas injection |
| SH | Southern Hemisphere |
| SIO | Scripps Institution of Oceanography (United States) |
| SOLVE | SAGE III Ozone Loss and Validation Experiment |
| SPARC | Stratospheric Processes and Their Role in Climate (WCRP) |
| SPOT | Satellite Pour l'Observation de la Terre (satellite) |
| SRES | Special Report on Emissions Scenarios (IPCC) |
| SRM | solid rocket motor |
| SSA | stratospheric sulfate aerosol |
| SSU | Stratospheric Sounding Unit |

| | |
|---------|---|
| STAR | System for Transfer of Atmospheric Radiation |
| STE | stratosphere-troposphere exchange |
| STRAT | Stratospheric Tracers of Atmospheric Transport |
| STREAM | Stratosphere-Troposphere Experiments by Aircraft Measurements |
| STS | supercooled ternary solution |
| STT | secondary tropical tropopause |
| SUNY | State University of New York (United States) |
| SUSPEN | Standardization of Ultraviolet Spectroradiometry in Preparation of a European Network |
| SUVDAMA | Scientific UV Data Management |
| SZA | solar zenith angle |
| 2-D | two-dimensional |
| 3-D | three-dimensional |
| TAR | Third Assessment Report (IPCC) |
| TEAP | Technology and Economic Assessment Panel (UNEP) |
| THESEO | Third European Stratospheric Experiment on Ozone |
| TIROS | Television Infrared Observation Satellite |
| TOMS | Total Ozone Mapping Spectrometer |
| TOVS | TIROS Operational Vertical Sounder |
| TRACE-P | Transport and Chemical Evolution over the Pacific |
| TT | tropical tropopause |
| TTL | tropical tropopause layer |
| TTT | thermal tropical tropopause |
| TUV | Tropospheric Ultraviolet Visible |
| UARS | Upper Atmosphere Research Satellite |
| UCI | University of California at Irvine (United States) |
| UEA | University of East Anglia (United Kingdom) |
| UH | University of Heidelberg (Germany) |
| UIUC | University of Illinois at Urbana-Champaign (United States) |
| UK | United Kingdom |
| UKMO | United Kingdom Meteorological Office |
| ULAU | Università degli Studi dell'Aquila (Italy) |
| UM | unified model |
| UMETRAC | Unified Model with Eulerian Transport and Chemistry |
| UN | United Nations |
| UNEP | United Nations Environment Programme |
| US | upper stratosphere |
| USDA | United States Department of Agriculture |
| UT | University of Tokyo (Japan) |
| UT | upper troposphere |
| UV | ultraviolet |
| VOC | volatile organic compound |
| WCRP | World Climate Research Programme |
| WMGHG | well-mixed greenhouse gas |
| WMO | World Meteorological Organization |
| WOUDC | World Ozone and Ultraviolet Radiation Data Centre (Canada) |

APPENDIX C

MAJOR CHEMICAL FORMULAE AND NOMENCLATURE FROM THIS ASSESSMENT

HALOGEN-CONTAINING SPECIES

| | | | |
|---|---------------------------------------|--|---------------------|
| Cl | atomic chlorine | Br | atomic bromine |
| Cl ₂ | molecular chlorine | Br ₂ | molecular bromine |
| ClO | chlorine monoxide | BrO | bromine monoxide |
| ClO _x | chlorine radicals | BrO _x | bromine radicals |
| OCIO | chlorine dioxide | OBrO | bromine dioxide |
| ClOO | chloroperoxy radical | | |
| Cl ₂ O ₂ , ClOOCl | dichlorine peroxide (ClO dimer) | | |
| ClONO | chlorine nitrite, nitryl chloride | | |
| ClONO ₂ , ClNO ₃ | chlorine nitrate | BrONO ₂ , BrNO ₃ | bromine nitrate |
| HCl | hydrogen chloride (hydrochloric acid) | HBr | hydrogen bromide |
| HOCl | hypochlorous acid | HOBr | hypobromous acid |
| Cl _y | inorganic chlorine | Br _y | inorganic bromine |
| CCl _y | organic chlorine | CBr _y | organic bromine |
| BrCl | bromine chloride | BrOOCl | bromochloroperoxide |
| F | atomic fluorine | I | atomic iodine |
| F ₂ | molecular fluorine | I ₂ | molecular iodine |
| | | IO | iodine monoxide |
| | | OIO | iodine dioxide |
| | | IONO ₂ | iodine nitrate |
| HF | hydrogen fluoride (hydrofluoric acid) | HI | hydrogen iodide |
| | | HOI | hypoiodous acid |
| SF ₆ | sulfur hexafluoride | | |
| SF ₅ CF ₃ | trifluoromethylsulfurpentafluoride | | |
| NF ₃ | nitrogen trifluoride | | |

HALOCARBONS

CHLOROFLUOROCARBONS (CFCs)

| | |
|----------|---|
| CFC-11 | CCl ₃ F |
| CFC-12 | CCl ₂ F ₂ |
| CFC-13 | CClF ₃ |
| CFC-113 | CCl ₂ FCClF ₂ |
| CFC-113a | CCl ₃ CF ₃ |
| CFC-114 | CClF ₂ CClF ₂ |
| CFC-114a | CCl ₂ F ₂ CF ₃ |
| CFC-115 | CClF ₂ CF ₃ |

HYDROCHLOROFLUOROCARBONS (HCFCs)

| | |
|------------|--|
| HCFC-21 | CHCl ₂ F |
| HCFC-22 | CHClF ₂ |
| HCFC-31 | CH ₂ ClF |
| HCFC-123 | CHCl ₂ CF ₃ |
| HCFC-124 | CHClF ₂ CF ₃ |
| HCFC-141b | CH ₃ CCl ₂ F |
| HCFC-142b | CH ₃ CClF ₂ |
| HCFC-225ca | CHCl ₂ CF ₂ CF ₃ |
| HCFC-225cb | CHClF ₂ CF ₂ CClF ₂ |
| HCFC-243cc | CH ₃ CF ₂ CFCl ₂ |

CHEMICAL FORMULAE

HYDROFLUOROCARBONS (HFCs)

| | | | |
|-----------|---|---------------|---|
| HFC-23 | CHF ₃ | HFC-245cb | CH ₃ CF ₂ CF ₃ |
| HFC-32 | CH ₂ F ₂ | HFC-245ca | CH ₂ FCF ₂ CHF ₂ |
| HFC-41 | CH ₃ F | HFC-245ea | CHF ₂ CHFCHF ₂ |
| HFC-125 | CHF ₂ CF ₃ | HFC-245eb | CH ₂ FCHFCF ₃ |
| HFC-134 | CHF ₂ CHF ₂ | HFC-245fa | CHF ₂ CH ₂ CF ₃ |
| HFC-134a | CH ₂ FCF ₃ | HFC-263fb | CH ₃ CH ₂ CF ₃ |
| HFC-143 | CH ₂ FCHF ₂ | HFC-272ca | CH ₃ CF ₂ CH ₃ |
| HFC-143a | CH ₃ CF ₃ | HFC-281ea | CH ₃ CHFCH ₃ |
| HFC-152 | CH ₂ FCH ₂ F | HFC-365mfc | CH ₃ CF ₂ CH ₂ CF ₃ |
| HFC-152a | CH ₃ CHF ₂ | HFC-356mcf | CH ₂ FCH ₂ CF ₂ CF ₃ |
| HFC-161 | CH ₃ CH ₂ F | HFC-356mff | CF ₃ CH ₂ CH ₂ CF ₃ |
| HFC-227ea | CF ₃ CHF ₂ CF ₃ | HFC-338pcc | CHF ₂ CF ₂ CF ₂ CHF ₂ |
| HFC-236cb | CH ₂ FCF ₂ CF ₃ | HFC-43-10mee | CF ₃ CHFCHF ₂ CF ₂ CF ₃ |
| HFC-236ea | CHF ₂ CHF ₂ CF ₃ | HFC-458mfcf | CF ₃ CH ₂ CF ₂ CH ₂ CF ₃ |
| HFC-236fa | CF ₃ CH ₂ CF ₃ | HFC-55-10mcff | CF ₃ CF ₂ CH ₂ CH ₂ CF ₂ CF ₃ |

HALONS

| | | | |
|------------|---------------------------------|------------|-------------------------------------|
| Halon-1202 | CBr ₂ F ₂ | Halon-1301 | CBrF ₃ |
| Halon-1211 | CBrClF ₂ | Halon-2402 | CBrF ₂ CBrF ₂ |

CHLOROCARBONS

| | |
|---|-------------------------------------|
| CH ₃ Cl | methyl chloride, chloromethane |
| CH ₂ Cl ₂ | methylene chloride, dichloromethane |
| CHCl ₃ | chloroform, trichloromethane |
| CCl ₄ | carbon tetrachloride |
| C ₂ HCl ₃ | trichloroethene, trichloroethylene |
| C ₂ Cl ₄ | tetrachloroethene, perchloroethene |
| CH ₃ CH ₂ Cl | chloroethane |
| CH ₂ ClCH ₂ Cl | 1, 2 dichloroethane |
| CH ₃ CCl ₃ | methyl chloroform |
| C ₂ H ₂ Cl ₄ | tetrachloroethane |
| C ₄ Cl ₆ | hexachlorobutadiene |
| COCl ₂ | phosgene, carbonyl chloride |

IODOCARBONS

| | |
|--|---------------------------------|
| CH ₃ I | iodomethane, methyl iodide |
| CH ₂ I ₂ | diiodomethane |
| CH ₃ CH ₂ I | iodoethane, ethyl iodide |
| CH ₃ CHICH ₃ (i-C ₃ H ₇ I) | 2-iodopropane, isopropyl iodide |
| CH ₃ CH ₂ CH ₂ I (n-C ₃ H ₇ I) | 1-iodopropane, n-propyl iodide |

OTHERS

| | |
|----------------------|----------------------|
| CHBr ₂ Cl | dibromochloromethane |
| CH ₂ BrCl | bromochloromethane |
| CHBrCl ₂ | bromodichloromethane |
| CH ₂ BrI | bromoiodomethane |
| CHBrF ₂ | bromodifluoromethane |
| CH ₂ ClI | chloroiodomethane |

BROMOCARBONS

| | |
|--|--|
| CH ₃ Br | methyl bromide, bromomethane |
| CH ₂ Br ₂ | methylene bromide, dibromomethane |
| CHBr ₃ | bromoform, tribromomethane |
| CH ₂ BrCH ₂ Br | 1,2 dibromoethane |
| CH ₃ CH ₂ CH ₂ Br (n-C ₃ H ₇ Br) | 1-bromopropane, n-propyl bromide, n-PB |
| CH ₃ C(O)CH ₂ Br | bromoacetone |

FLUOROCARBONS

| | |
|---|---|
| CF ₄ | tetrafluoromethane, carbon tetrafluoride |
| C ₂ F ₆ , CF ₃ CF ₃ | perfluoroethane |
| C ₃ F ₈ , CF ₃ CF ₂ CF ₃ | perfluoropropane |
| c-C ₃ F ₆ | perfluorocyclopropane |
| C ₄ F ₁₀ | perfluorobutane |
| c-C ₄ F ₈ | perfluorocyclobutane |
| C ₅ F ₁₂ | perfluoropentane |
| C ₆ F ₁₄ | perfluorohexane |
| COF ₂ | carbonyl fluoride |
| TFA | trifluoroacetic acid (CF ₃ COOH) |
| CF ₃ COF | trifluoroacetyl fluoride |

| | |
|-----------------------------------|--|
| CF ₃ I | trifluoromethyl iodide, trifluoroiodomethane |
| CF ₃ CF ₂ I | iodopentafluoroethane |
| COClF | chlorofluorocarbonyl |
| CF ₃ COCl | trifluoroacetyl chloride |
| SF ₆ | sulfur hexafluoride |
| SF ₅ CF ₃ | trifluoromethylsulfurpentafluoride |

OTHER SPECIES

| | | | |
|-------------------------------------|--|--|--|
| O | atomic oxygen | H | atomic hydrogen |
| O(³ P) | atomic oxygen (ground state) | H ₂ | molecular hydrogen |
| O(¹ D) | atomic oxygen (first excited state) | OH | hydroxyl radical |
| O ₂ | molecular oxygen | HO ₂ | hydroperoxyl radical |
| O ₃ | ozone | H ₂ O | water |
| O _x | odd oxygen (O, O(¹ D), O ₃) or oxidant (O ₃ + NO ₂) | H ₂ O ₂ | hydrogen peroxide |
| | | HO _x | odd hydrogen (H, OH, HO ₂ , H ₂ O ₂) |
| | | HDO | deuterated water |
| N | atomic nitrogen | HNO ₂ , HONO | nitrous acid |
| N ₂ | molecular nitrogen | HOONO | pernitrous acid |
| N ₂ O | nitrous oxide | HNO ₃ | nitric acid |
| NO | nitric oxide | HNO ₄ , HO ₂ NO ₂ | peroxynitric acid, pernitric acid |
| NO ₂ | nitrogen dioxide | CH ₃ OONO ₂ | methylperoxynitrate |
| NO ₃ | nitrogen trioxide, nitrate radical | PAN | peroxyacetylnitrate (CH ₃ C(O)OONO ₂) |
| N ₂ O ₅ | dinitrogen pentoxide | RONO ₂ | alkyl nitrates |
| NO _x | nitrogen oxides (NO + NO ₂) | NAD | nitric acid dihydrate (HNO ₃ ·2H ₂ O) |
| NO _y | total reactive nitrogen (usually includes NO, NO ₂ , NO ₃ , N ₂ O ₅ , ClONO ₂ , HNO ₄ , HNO ₃) | NAT | nitric acid trihydrate (HNO ₃ ·3H ₂ O) |
| | | NAP | nitric acid pentahydrate (HNO ₃ ·5H ₂ O) |
| S | atomic sulfur | H ₂ S | hydrogen sulfide |
| SO ₂ | sulfur dioxide | CS ₂ | carbon disulfide |
| SO ₄ | sulfate | COS, OCS | carbonyl sulfide |
| H ₂ SO ₄ | sulfuric acid | | |
| CH ₃ SCH ₃ | DMS, dimethyl sulfide | | |
| CH ₃ S(O)CH ₃ | DMSO, dimethyl sulfoxide | | |
| CH ₃ SO ₃ H | MSA, methanesulfonic acid | | |
| C | carbon atom | | |
| CO | carbon monoxide | | |
| CO ₂ | carbon dioxide | | |
| NMHC | nonmethane hydrocarbon | CH ₂ O, HCHO | formaldehyde |
| CH ₄ | methane | CH ₃ COCH ₃ | acetone |
| C ₂ H ₆ | ethane | CH ₃ OOH | methyl hydroperoxide |
| C ₃ H ₈ | propane | CH ₃ COO | methyl peroxy radical |
| C ₂ H ₄ | ethylene, ethene | CH ₃ C(O)OO | acetyl peroxy radical |
| C ₂ H ₂ | acetylene, ethyne | RO | alkoxy radicals |
| | | RO ₂ | organic peroxy radicals |