

APPENDIX I. UNUSED DATA

Based on the requirements set forth in the guidelines (Stephan et al. 1985), the following studies are not acceptable for the following reasons and are classified as unused data.

Studies Were Conducted with Species That Are Not Resident in North America

Abalde et al. (1995)	Kadioglu and Ozbay (1995)	Raj and Hameed (1991)
Abel (1980)	Karbe (1972)	Rajkumar and Das (1991)
Ahsanullah and Ying (1995)	Knauer et al. (1997)	Reeve et al. (1977)
Ahsanullah et al. (1981)	Kulkarni (1983)	Ruiz et al. (1994, 1996)
Aoyama and Okamura (1984)	Kumar et al. (1985)	Saward et al. (1975)
Austen and McEvoy (1997)	Lan and Chen (1991)	Schafer et al. (1993)
Bougis (1965)	Lee and Xu (1984)	Smith et al. (1993)
Cid et al. (1995, 1996a,b)	Luderitz and Nicklisch (1989)	Solbe and Cooper (1976)
Collvin (1984)	Majori and Petronio (1973)	Steehan-Nielsen and Bruun-Laursen (1976)
Cosson and Martin (1981)	Masuda and Boyd (1993)	Stephenson (1983)
Daly et al. (1990a,b, 1992)	Mathew and Fernandez (1992)	Takamura et al. (1989)
Denton and Burdon-Jones (1986)	Maund et al. (1992)	Taylor et al. (1991, 1994)
Drbal et al. (1985)	Migliore and Giudici (1988)	Timmermans (1992)
Giudici and Migliore (1988)	Mishra and Srivastava (1980)	Timmermans et al. (1992)
Giudici et al. (1987, 1988)	Negilski et al. (1981)	Vardia et al. (1988)
Gopal and Devi (1991)	Nell and Chvojka (1992)	Verriopoulos and Moraitou- Apostolopoulou (1982)
Gustavson and Wangberg (1995)	Neuhoff (1983)	Visviki and Rachlin (1991)
Hameed and Raj (1989)	Nias et al. (1993)	Weeks and Rainbow (1991)
Heslinga (1976)	Nonnotte et al. (1993)	White and Rainbow (1982)
Hori et al. (1996)	Pant et al. (1980)	Wong and Chang (1991)
Huebner and Pynnonen (1992)	Paulij et al. (1990)	Wong et al. (1993)
Ismail et al. (1990)	Peterson et al. (1996)	
Jana and Bandyopadhyaya (1987)	Pistocchi et al. (1997)	
Jindal and Verma (1989)	Pynnonen (1995)	
Jones (1997)		

Copper Was a Component of a Drilling Mud, Effluent, Mixture, Sediment, or Sludge

Buckler et al. (1987)	Kraak et al. (1993 and 1994a,b)	Roch et al. (1986)
Buckley (1994)	Lowe (1988)	Sayer et al. (1991b)
Clements et al. (1988)	McNaught (1989)	Weis and Weis (1993)
de March (1988)	Munkittrick and Dixon (1987)	Widdows and Johnson (1988)
Hollis et al. (1996)	Pellegrini et al. (1993)	Wong et al. (1982)
Horne and Dunson (1995)	Roch and McCarter (1984a,b)	
Hutchinson and Sprague (1987)		

These Reviews Only Contain Data That Have Been Published Elsewhere

Ankley et al. (1993)	Felts and Heath (1984)	Peterson et al. (1996)
Borgmann and Ralph (1984)	Gledhill et al. (1997)	Phillips and Russo (1978)
Chapman et al. (1968)	Handy (1996)	Phipps et al. (1995)
Chen et al. (1997)	Hickey et al. (1991)	Spear and Pierce (1979b)
Christensen et al. (1983)	Janssen et al. (1994)	Starodub et al. (1987b)
Dierickx and Brendael-Rozen (1996)	LeBlanc (1984)	Taylor et al. (1996)
DiToro et al. (1991)	Lilius et al. (1994)	Thompson et al. (1972)
Eisler (1981)	Meyer et al. (1987)	Toussaint et al. (1995)
Eisler et al. (1979)	Ozoh (1992c)	
Enserink et al. (1991)		

No Interpretable Concentration, Time, Response Data, or Examined Only a Single Concentration

Asztalos et al. (1990)	Koltes (1985)	Sayer (1991)
Beaumont et al. (1995a,b)	Kosalwat and Knight (1987)	Sayer et al. (1991a,b)
Beckman and Zaugg (1988)	Kuwabara (1986)	Schleuter et al. (1995, 1997)
Bjerselius et al. (1993)	Lauren and McDonald (1985)	Starcevic and Zielinski (1997)
Carballo et al. (1995)	Leland (1983)	Steele (1989)
Daoust et al. (1984)	Lett et al. (1976)	Taylor and Wilson (1994)
De Boeck et al. (1995b, 1997)	Miller and McKay (1982)	Viale and Calamari (1984)
Dick and Dixon (1985)	Mis and Bigaj (1997)	Visviki and Rachlin (1994b)
Felts and Heath (1984)	Nalewajko et al. (1997)	Waiwood (1980)
Ferreira (1978)	Nemcsok et al. (1991)	Webster and Gadd (1996)
Ferreira et al. (1979)	Ozoh (1990)	Wilson and Taylor (1993a,b)
Hansen et al. (1993, 1996)	Ozoh and Jacobson (1979)	Winberg et al. (1992)
Heath (1987, 1991)	Parrott and Sprague (1993)	Wundram et al. (1996)
Hughes and Nemcsok (1988)	Pyatt and Dodd (1986)	Wurts and Perschbacher (1994)
Julliard et al. (1996)	Riches et al. (1996)	

No Useable Data on Copper Toxicity or Bioconcentration

Cowgill et al. (1986)	Lustigman et al. (1985)	Wong et al. (1977)
de March (1979)	MacFarlane et al. (1986)	Wren and McCarroll (1990)
Lehman and Mills (1994)	van Hoof et al. (1994)	Zamuda et al. (1985)
Lustigman (1986)	Weeks and Rainbow (1992)	

Results Not Interpretable as Total or Dissolved Copper

Brand et al. (1986)	Sanders and Martin (1994)	Sunda et al. (1987)
MacFie et al. (1994)	Sanders et al. (1995)	Winberg et al. (1992)
Riedel (1983)	Stearns and Sharp (1994)	
Sanders and Jenkins (1984)	Stoecker et al. (1986)	

Some of these studies would be valuable if copper criteria were developed on the basis of cupric ion activity.

Organisms Were Selected, Adapted or Acclimated for Increased Resistance to Copper

Fisher (1981)	Munkittrick and Dixon (1989)	Schmidt (1978a,b)
Fisher and Fabris (1982)	Myint and Tyler (1982)	Sheffrin et al. (1984)
Hall (1980)	Neuhoff (1983)	Steele (1983b)
Hall et al. (1989)	Parker (1984)	Takamura et al. (1989)
Harrison and Lam (1983)	Phelps et al. (1983)	Viarengo et al. (1981a,b)
Harrison et al. (1983)	Ray et al. (1981)	Wood (1983)
Lumoa et al. (1983)	Sander (1982)	
Lumsden and Florence (1983)	Scarfe et al. (1982)	

Either the Materials, Methods, Measurements or Results Were Insufficiently Described

Abbe (1982)	Gibbs et al. (1981)	Peterson et al. (1996)
Alam and Maughan (1995)	Gordon et al. (1980)	Pophan and D'Auria (1981)
Balasubrahmanyam et al. (1987)	Gould et al. (1986)	Reed-Judkins et al. (1997)
Baudouin and Scoppa (1974)	Govindarajan et al. (1993)	Rehwoldt et al. (1973)
Belanager et al. (1991)	Hayes et al. (1996)	Riches et al. (1996)
Benedeczky et al. (1991)	Howard and Brown (1983)	Sakaguchi et al. (1977)
Benedetti et al. (1989)	Janssen et al. (1993)	Sanders et al. (1995)
Benhra et al. (1997)	Janssen and Persoone (1993)	Sayer (1991)
Bouquegneau and Martoja (1982)	Kean et al. (1985)	Schultheis et al. (1997)
Burton and Stemmer (1990)	Kentouri et al. (1993)	See et al. (1974)
Burton et al. (1992)	Kessler (1986)	Shcherban (1977)
Cabejszek and Stasiak (1960)	Khangarot et al. (1987)	Smith et al. (1981)
Cain and Luoma (1990)	Kobayashi (1996)	Sorvari and Sillanpaa (1996)
Chapman (1975, 1982)	Kulkarni (1983)	Stearns and Sharp (1994)
Cochrane et al. (1991)	Labat et al. (1977)	Strong and Luoma (1981)
Devi et al. (1991)	Lakatos et al. (1993)	Sullivan and Ritacco (1988)
Dirilgen and Inel (1994)	LeBlanc (1985)	Taylor (1978)
Dodge and Theis (1979)	Leland et al. (1988)	Taylor et al. (1994)
Doucet and Maly (1990)	Mackey (1983)	Thompson (1997)
Dunbar et al. (1993)	Magni (1994)	Trucco et al. (1991)
Durkina and Evtushenko (1991)	Martin et al. (1984)	Verma et al. (1980)
Enesco et al. (1989)	Martincic et al. (1984)	Visviki and Rachlin (1994a)
Erickson et al. (1997)	McIntosh and Kevern (1974)	Watling (1983)
Evans (1980)	McKnight (1980)	Winner et al. (1990)
Ferrando and Andreu (1993)	Moore and Winner (1989)	Young and Harvey (1988, 1989)
Finlayson and Ashuckian (1979)	Muramoto (1980, 1982)	Zhokhov (1986)
Furmanska (1979)	Nyholm and Damgaard (1990)	

Questionable Effect Levels Due to Graphical Presentation of Results

Alliot and Frenet-Piron (1990)	Gupta et al. (1985)	Pekkala and Koopman (1987)
Andrew (1976)	Hansen et al. (1996)	Peterson et al. (1984)
Arsenault et al. (1993)	Hoare and Davenport (1994)	Romanenko and Yevtushenko (1985)
Balasubrahmanyam et al. (1987)	Lauren and McDonald (1985)	Sanders et al. (1994)
Bjerselius et al. (1993)	Llanten and Greppin (1993)	Smith and Heath (1979)
Bodar et al. (1989)	Metaxas and Lewis (1991)	Stokes and Hutchinson (1976)
Chen (1994)	Michnowicz and Weeks (1984)	Winner and Gauss (1986)
Cowgill and Milazzo (1991b)	Miersch et al. (1997)	Wong (1989)
Cvetkovic et al. (1991)	Nasu et al. (1988)	Young and Lisk (1972)
Dodoo et al. (1992)	Pearlmutter and Lembi (1986)	
Francisco et al. (1996)		

Studies of Copper Complexation With No Useable Toxicology Data for Surface Waters

Borgmann (1981)	Jennett et al. (1982)	Swallow et al. (1978)
Filbin and Hough (1979)	Maloney and Palmer (1956)	van den Berg et al. (1979)
Frey et al. (1978)	Nakajima et al. (1979)	Wagemann and Barica (1979)
Gillespie and Vaccaro (1978)	Stauber and Florence (1987)	
Guy and Kean (1980)	Sunda and Lewis (1978)	

Questionable Treatment of Test Organisms or Inappropriate Test Conditions or Methodology

Arambasic et al. (1995)	Hockett and Mount (1996)	Ozoh and Jones (1990b)
Benhra et al. (1997)	Huebert et al. (1993)	Reed and Moffat (1983)
Billard and Roubaud (1985)	Huilsom (1983)	Rueter et al. (1981)
Bitton et al. (1995)	Jeziarska and Slominska (1997)	Sayer et al. (1989)
Brand et al. (1986)	Kapu and Schaeffer (1991)	Schenck (1984)
Bringmann and Kuhn (1982)	Kessler (1986)	Shaner and Knight (1985)
Brkovic-Popovic and Popovic (1977a,b)	Khangarot and Ray (1987a)	Sullivan et al. (1983)
Dirilgen and Inel (1994)	Khangarot et al. (1987)	Tomasik et al. (1995)
Folsom et al. (1986)	Lee and Xu (1984)	Watling (1981, 1982, 1983)
Foster et al. (1994)	Marek et al. (1991)	Wikfors and Ukeles (1982)
Gavis et al. (1981)	McLeese (1974)	Wilson (1972)
Guanzon et al. (1994)	Mis et al. (1995)	Wong and Chang (1991)
Hawkins and Griffith (1982)	Moore and Winner (1989)	Wong (1992)
Ho and Zubkoff (1982)	Nasu et al. (1988)	

High control mortalities occurred in all except one test reported by Sauter et al. (1976). Control mortality exceeded 10% in one test by Mount and Norberg (1984). Pilgaard et al. (1994) studied interactions of copper and hypoxia, but failed to run a hypoxic control. Beaumont et al. (1995a,b) studied interactions of temperature, acid pH and copper, but never separated pH and copper effects. The 96-hour values reported by Buikema et al. (1974a,b) were subject to error because of possible reproductive interactions (Buikema et al. 1977).

**Bioconcentration Studies Not Conducted Long Enough, Not Steady-State,
Not Flow-through, or Water Concentrations Not Adequately Characterized or Measured**

Anderson and Spear (1980a)
Felton et al. (1994)
Griffin et al. (1997)
Harrison et al. (1988)
Krantzberg (1989)

Martincic et al. (1992)
McConnell and Harrel (1995)
Miller et al. (1992)
Ozoh (1994)
Wright and Zamuda (1987)

Xiaorong et al. (1997)
Yan et al. (1989)
Young and Harvey (1988, 1989)
Zia and Alikhan (1989)

Anderson (1994), Anderson et al. (1994), Viarengo et al. (1993), and Zaroogian et al. (1992) reported on *in vitro* exposure effects. Benedeczky et al. (1991) studied only effects of injected copper. Ferrando et al. (1993b) studied population effects of copper and cladoceran predator on the rotifer prey, but the data are difficult to interpret. A similar problem complicated use of the cladoceran competition study of LeBlanc (1985).