CORRECTIONS FOR CHROMIUM(VI) HANDBOOK **(12/04/04; 020316)**

Guertin, J., Jacobs, J., and Avakian, C., eds., 2005, *Chromium (VI) Handbook*, CRC Press, Boca Raton, Florida; 784 p.

Chapter 1

p. 3: 1.2.1: Even dental technologists . . . (pneumoconiosis) . . . chromium-cobalt-molybdenum (Cr-Co-Mo) . . .
p. 4: 1.2.2: 2nd paragraph: 400 °C needs space
p. 6: 1.2.4: end of 1st paragraph: These in situ technologies use paired redox . . .
Also, 2nd paragraph: A variety of technologies (known as "pump and treat") . . .
1.2.5: 1st paragraph: *Priority List of Hazardous Substances* (ATSDR 1999a)
Also, . . . Cr(VI) has been found in at least 306 of the 1,591 . . .
p. 7: 1.2.6: . . . reducing blood glucose and is . . . delete "levels"
Also, . . . blood cholesterol by reducing the . . . better term than lowering
Cr(III) is an . . . protein, and fat. The minimum human daily Cr requirement . . . 50 μg/d to 200 μg/d not /L
. . . according to ATSDR (2000)
p. 8: Figure 1.1: Lead chromate mineral, crocoite, . . .
p. 9: 1.2.3: 5th paragraph: Fourcroy and Abbé . . . suggested the name chromium from . . . Don't use the chemical symbol here
p. 10: With the discovery . . . These rocks were shown to Isaac . . . delete comma
p. 13: 1.4: 1st paragraph: . . . high melting point (1,907 °C) and boiling point (2,671 °C).
Note space and change of values to match Chapter 2.
p. 14: 1st Equation: $Cr_2O_3 + 2Al \rightarrow 2Cr + Al_2O_3$ . . . font error, not A1 and not $A1_2O_3$
This is a lower case "el" not a "one"
p. 16: TABLE 1.1: Human joint replacement parts (hip)
p. 18: 1.5.9: 1st paragraph: Starting . . . Cr has been oxidized to Cr(VI). Delete comma
p. 19: 1.6: 2nd paragraph: Prevention efforts . . . cleanup costs. This is not a footnote. It starts the 2nd paragraph
p. 21: U.S. Environmental Protection Agency . . .
http://www.epa.gov/safewater/contaminants/dw_contamfs/chromium.html
p. 21: Bibliography: Selden, ... Exposure to cobalt-chromium dust and . . .
P. 21: 1st USEPA is 1996a; 2nd USEPA is 1996b; 3rd USEPA:
http://www.epa.gov/safewater/contaminants/dw_contamfs/chromium.html

Chapter 2

Final edits for were submitted to CRC on time and incorporated into *First Printing*

Chapter 3

p. 95: The influence of the movie *Erin Brockovich* in the year 2000 . . .
p. 96: 1st Paragraph: . . . including the minor sulfate (SO_4^{2-}) minerals that . . .
p. 104: 3.1.4.2.2: . . . RI of the Presidio (Dames and Moore, 1997a), . . .
. . . and Feasibility Study (FS) (Dames and Moore, 1997a, 1997b).
p. 107: the scale inside Figure 3.1.4 should have lower case . . .
like this: scale in km
p. 108: 3.1.4.3.4: Historical Eh (oxidation–reduction) and pH . . .
. . . in low to neutral pH (pH < 7 to pH = 7) . . .
. . . the dominant oxidation state in alkaline (pH > 7)
p. 117: Table 3.1.7: under Leaching Solution: . . . 125 mL to 2 mmol/L
under Other Additions: . . . 29 mmol/L
p. 138: 3.2.1 2nd Paragraph: . . . pH 5 and Eh > 0.8 V . . .

Chapter 4

p.144: Table 4.1.1: Cr(0) . . . it's a zero not an "O"

p. 145: Table 4.1.3: 27 °C . . . space needed
p. 146: Table 4.1.4: $PbCrO_4$ not $PbCrO_4$b
p. 147: There is a trend in the steel industry towards lower grade ferrochromium
p. 148: Table 4.1.5: add blank line to separate Mass (kg) in . . .
p. 149: $Cr(OH)_3 \cdot H_2O$ . . . dot should be slightly larger and centered
Fe oxyhydroxide [FeO(OH)] . . . space needed
p. 152: all the /y should be /year . . . there is no common abbreviation for year
p. 153: Table 4.1.6: total (XRF) should be total (XRF). . . Also, <0.063 mm. . . all on same line aqua regia. . . Also, remove quotes from <0.18 mm "total" (ICP–AES)
p. 154: <0.45 μm . . . all on same line
Also, . . . headings are screwed up
p. 155: . . . headings are screwed up
p. 156: N = normality = equivalents/L of solution . . . not gequivalents .. . . Also, = 60.0 g/2
p. 158: trace to 1,000 . . . not trace-1000
p. 159: Fly ash here means trapped and bottom ash (not airborne fly ash)
p. 161: 2,900 kg/year and 4,100 kg/year
p. 162: American Wood Preservers Institute (AWPI) . . . switch order
p. 163: Rouse . . . not Rose

Chapter 5

p.167: 1st paragraph: This chapter . . . of Cr(VI), and chromium (Cr) in general, . . .
p. 168: . . . usually associated with the very soluble chromates (CrO_4^{2-}) . . .
Also, . . . 5.1.1: 1st paragraph: including chromium pigments such as $BaCrO_4$, $CaCrO_4$, $PbCrO_4$, $SrCrO_4$, and $ZnCrO_4$.
p. 169: . . . Chemicals . . . metal plating (which use chromic acid [$H_2Cr_2O_7$]), . . .
5.1.2: 0.02 μmol/g to 58 μmol/g . . . delete the dot
p. 170: 5.2.1: In relatively low Eh environments, the main Cr(III) constituents are . . .
p. 172: 5.3.1: Eh = (pe)(2.3RT/F) (5.2)
p. 173: 5.3.2: $Cr(III) \rightarrow Cr(VI)$ (5.3)
$2Cr_2O_3 + 3O_2 \rightarrow 4CrO_3$ (5.4) . . . line up arrows
p. 175: 5.3.3.1: $2CrOH_2^+ + 3\delta\text{-}MnO_2$ . . . no space between δ-Mn
p. 176: remove dot in both equations . . . $3\delta\text{-}MnO_2(s)$
Also, . . . The solid MnOOH(s) would dissolve later into Mn^{2+}(aqueous). Delete decay into aqueous Mn^2 afterwards and replace with above.
p. 178: del the minus sign on equation 5.7; also, why offset the equation?
p. 184: . . . heavy "metals", i.e., metals with density greater than 5 g/cm^3 such as Cd^{2+}, Co^{2+}, and Zn^{2+}; . . .Note quotes and the space between 5 and g/cm^3.
p. 185: 5.6.1: 1st paragraph: i.e., CrO_4^{2-} and $Cr_2O_7^{2-}$, pigments, chromium(VI) oxide
p. 191: 5.6.2.3.3: . . . 34% arsenic(V) oxide (As_2O_5) . . . delete space and it's a subscript 5 not s.
p. 192: 5.6.2.3.4: . . . Concentrations of total copper (Cu), . . . not (Cr)
p. 195: *pH*: . . .in the retention of metals in soils (Jenne, 1968) . . . not 1960
p. 196: . . . citric acid ($H_3C_6H_5O_7$) not C_4
p. 201: 5.7.1: The presence of Cr(III) . . . chromium(III) hydroxide, $Cr(OH)_3$
p. 202: equation 5.8: $M_o < M_{TOT} = X_c A \rho_b R_c$ ρ is *not* a subscript; b *is* a subscript
p. 204: 5.7.2.4: 2nd last sentence: . . . concentration that is greater than zero that . . .
p. 205: 5.7.3.3: 1st paragraph: . . . become progressively enriched in the isotopes with the higher mass number . . .
delete "heavier"

Chapter 6

Final edits for were submitted to CRC on time and incorporated into *First Printing*

Chapter 7

p. 247: 7.3.2: 2nd paragraph: . . . Refer to Geoprobe 2003 . . .
p.250: 7.3.3.2: The ConeSipper® water . . . delete space before ®Note that register trade mark is superscript.
p. 251: 7.4: 1st paragraph: . . . delineate zones containing "heavy" metals . . .

p. 252: 7.4.3: 0.9 kg lower case k
p. 258: 7.6.1: last paragraph: . . . UN rated or approved 208 L (55-gallon)
7.6.2: . . . and free product (petroleum . . . nonaqueous phase [LNAPL]) delete "for" and insert parentheses as shown; no hyphen after "non"
p. 265: Table 7.3: *Solids*: 4th column: Determine concentration of dissolved Cr(VI) . . .
p. 268: Figure 7.6: 1st arrow is not centered on line

Chapter 8

p. 281: $PbCrO_4 \cdot H_2O$ . . . dot needs to be larger and centered better
p.282: 8.2.1: L/d . . . abbreviation for day is d
p. 285: 8.3.1: 2nd last paragraph: 41 atm (4.2×10^5 kg_{force}/m^2
Also, 340 atm (3.5×10^6 kg_{force}/m^2)
p. 287: In general, cells do not take up Cr(III) because it is not water soluble as $Cr(OH)_3$.
p. 289: the dot is not quite centered for . . . ·OH radicals . . . occurs *twice*
p. 294: . . . where e = 2.718 . . . (base of natural logarithm)
p. 303: 8.5.2: 2.721 metric tons/h to 5.442 metric tons/h.

Chapter 9

p. 311: 9.1.2.2.5: Chromium Mobility upon Oxidation
p. 312: 1st sentence . . . where field-scale deployment of the *in situ* redox manipulation (ISRM) technology . . .
p. 315: 9.1.2.1: Equation 9.1.1, the $2SO_2 \cdot^-$ need a larger dot
p. 317: 9.1.2.2: . . . Eh = –0.771 V . . . note the spaces; also, move the "Eh = –0.771 V" more to the right
p. 329: Insert blank line above "*Assumptions*" with no blank line after this heading
p. 330: No blank line under heading "Electron Acceptor"; Also, *Scenario 1* . . . ital
Also, insert blank line above "*Longevity in Years*" with no blank line after this heading
p. 337: 9.2.3: 4th paragraph: When sulfur (S) is reacted with calcium (Ca) metal . . .Note the spaces
p. 339: equation 9.2.15 . . . line up the → with others above
p. 343: Table 9.2.2: last column, Ratio of CaS_5/Cr(VI) . . . not CaS_s/Cr(VI)
p. 349: 9.3.1: 2nd last paragraph: Schoolcraft is one word
p. 351: Figure 9.3.1A: in legend, need comma: SO_4^{2-}, _ _ _ USEPA MCL
p. 354: Figure 9.3.3A: in legend, need comma: ——— total Cr, _ _ _ USEPA MCL Note the longer line on left of Cr; Also, for Figure 9.3.3B
p. 355: same as above for Figure 9.3.3C
p. 355: . . . lactic acid ($CH_3CHOHCOOH$) Note no space
p. 356: Bibliography . . . Hamm, R.E. . . . with chromium(III), lower case

Chapter 10

p. 362: 10.1: James A. Jacobs and Jim V. Rouse
p. 363: . . . and may be present in soil as secondary chromate minerals such as calcium chromate ($CaCrO_4$) or barium chromate ($BaCrO_4$). Or, Cr(VI) . . .
Note the period after ($BaCrO_4$)
p. 367: Figure 10.1.2: Font error, Times New Roman not used
p. 368: Figure 10.1.3: in the figure (box), Inorganic (i.e., iron) . . .
p. 371: 10.1.4.2: . . . pH < 10 . . . pH > 10 Note spacing
p. 372: Bibliography . . . Rouse, J.V., 1994, . . . Dissolved chromate-ion . . .
Also, there is lower case and capitalization inconsistency throughout.
p. 373: Bibliography: U.S. Environmental Protection . . . , 1999 . . . trichloroethylene in ground water . . . Note no hyphen and 2 words
p. 374: 10.2.4: last paragraph: 7,506 mg/kg
p. 376: 10.3.1: 10,000 m^2 not m^3
p. 378: 10.3.4: last paragraph: estimated solubility of $Cr(OH)_3$ is 0.0013 mg/L . . .
p. 382: 10.4.3.1.1: . . . 1965 to 1984 . . . copper(II) chromate ($CuCrO_4$). . .
No space between copper and II
p. 390: 10.5.3.2: 1997 to 2002: . . . 1998 to 1999:

p. 396: 10.6.2.1: 1st paragraph: The site was originally part of a 4.05×10^5 m^2 (10.5 hectare) parcel . . .
p. 397: 10.6.2.2: 1st paragraph: Chromium(III) nitrate ($Cr(NO)_3$), VOCs, and . . .
p. 404: Table 10.6.1: "Contaminant" column: remove parenthesis, Cd, CN^-, Pb, NO_3^-
p. 410: 10.7.5.1: 2nd paragraph: The addition of an iron(II) sulfate ($FeSO_4$) solution . .
p. 411: 10.7.6.1: $FeSO_4 \cdot 7H_2O$ . . . need larger dot
p. 415: 10.9.2.1: Coast Wood . . . on a 30,000 m^2 (3 hectare) site . . . no space
p. 417: 10.9.3.2: 1999: . . . the reducing agent calcium polysulfide (CaS_5) . . .
p. 420: 10.10.1: 2nd paragraph: . . . lactic acid ($CH_3CHOHCOOH$) not CODH
p. 429: 10.11.1: last paragraph: The co-author (Suthersan) . . .
p. 432: 10.11.3: last paragraph: (see calculation in box below, Jacques Guertin, . . .
p. 433: bottom of calculation box: . . . rounded off value
p. 443: 10.12.2.3: . . . K_d F_{oc} K_{oc} all not italic (there are many to change)
p. 446: Table 10.12.1: Cr(VI) column and Cr column, font problem: µg/g
p. 451: Again, K_d F_{oc} . . . all not italic
p. 452: Table 10.12.3: 2nd column: m bgs not M bgs (the m means meter)
p. 454: Table 10.12.4: 2nd column: m bgs . . . µg/g for columns 3 to 7
p. 458: font error for µg/g
p. 460: 10.12.5, item 2: 172 mg/kg to 1,002 mg/kg . . .
p. 459: Table 10.12.5: foot notes: µM = µmol/L. . . not µm = µmol/L

Chapter 11

p. 467: Equations 11.1.1 to 11.1.3: line up arrows and
move +1.33 V, +1.10 V, –0.09 V to right
also, . . . Cr(VI) acts as Cr^{6+} (a nonexistent ion) for charge balance in the equation.
p. 469: Table 11.1: delete mg/L under "Pretreatment and add mg/L to "Posttreatment"
Also, . . . Once the mixing phase . . . to settle to the ESP-600 cone . . .
p. 471: DI = deionized (water) . . . not dejonizes
p. 476–477: delete periods at end of each listed item
p. 479: Equation 11.3.4: $2Fe(OH)_3(s)$
p.480: $OH\cdot$ . . . center dot (occurs a few times); also, oxygen (O_2) and ozone (O_3)
also, don't' break up MnO_4^- and fluorine (F_2) . . . not Fl_2
p. 481: Figure 11.3.2: photoreduction; photooxidation
also, . . . $OH\cdot$ + organics $\rightarrow$ $CO_2 + H_2O$ space after the +
also, . . . $OH\cdot + H^-$ space after the +
p. 484: Figure 11.3.3: box: TREATMENT ELECTROCOAGULATION AND ELECTROOXIDATION . . .
bottom line looks faint on computer monitor but prints OK
p. 486: delete "Unit" column and add ppm to "Concentration (average) column

Chapter 12

p. 492: 2nd paragraph: By the middle of the 19th century, Cr, sliver (Ag) . . .note no parenthesis
p. 498: Table 12.1.2: "Concentration" column: µg/L note font error, strange µ
p. 499: Table 12.1.2: "Concentration" column: µg/L note font error, strange µ
p. 503: Bibliography: Borneff . . . with 3,4-benzopyrene
p.508: Table 12.2.1: Cr(VI) STEL value. . . also, Soluble Cr(VI) as zinc chromate ($ZnCrO_4$) note no space
also, line up decimals under "Standard" column
p. 509: Table 12.2.2.: line up decimals under "Standard" column
p. 510: Table 12.2.3: line up decimals under "Standard" column and 0.005 to 0.03; 5 to 250

Chapter 13

p. 525: 13.2.1: 2nd paragraph: For this reason . . . to the general public if Cr(VI) enters . . . delete "it"
p. 534: 13.3.7: item 2: . . . in a defendant's product or waste caused it)
p. 537: Concerning the animal studies, the court . . . PCB, but . . . not PCBs
p. 539: 13.4.4.1: 2nd paragraph: In addition to . . . during Pu production. no parenthesis
p. 541: 13.4.4.2.2: 5th paragraph: The court concluded that the plaintiffs produced . . . delete apostrophe

p. 544: 13.5.2.1: 2nd paragraph: . . . discharge of hazardous substances are not recoverable. . . .note the 1st dot is a period; all 4 dots are evenly spaced
p. 554: Endnotes: 3: . . . "Occupational Exposure to Cr(VI)" (available on . . .) delete 2nd Cr(VI)
Chapter 14
p. 565: 1st paragraph: . . . In 1977, . . . from chromate (CrO_4^{2-})-contaminated . . . note space
p. 566: In organic-carbon-poor subsurface . . . Depending on the . . . of nitrate (NO_3^-), Cr(VI), and sulfate (SO_4^{2-}) was observed . . . note spaces
. . . 100% removal utilizing sucrose (table sugar ($C_{12}H_{22}O_{11}$)), lactate ($C_3H_5O_3^-$), and yeast
next paragraph: . . . The presence of Cr(VI) . . . rate of the naphthalene ($C_{10}H_8$) . . . note space
p. 567: . . . and was routinely reduced to less than its analytical detection . . . delete "below"
Also, . . . next paragraph: . . . bacteria by adding an alkane (C_nH_{2n+2}) gas. An alkane gas, such as propane (C_3H_8), is used . . . note space
. . . table of process: Indirect reduction: Microbes reduce Cr(VI) by producing sulfide (S^{2-}), Fe(II), . . . note space
p. 569: 14.1.2: 2nd paragraph: dissolved oxygen (field), iron (total Fe^{2+}, field), nitrate (NO_3^-, lab), sulfate (SO_4^{2-}, lab) . . . note spaces
p. 570: . . . The photoreduction of Cr(VI) occurred after irradiation with either UVA (320 nm to 400 nm) or . . . UVB (290 nm to 320 nm)
p. 571: 14.1.4: 5th paragraph: For example, . . . lead(II) chromate ($PbCrO_4$) pigments, . . .
an aluminum (Al) extruding facility . . . no spaces
p. 572: Bibliography: Archibald, . . . American Petroleum Institute . . . not Petrolium

Comments or questions:

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