Table 4.2.9 Effect of sodium expressed as sodium adsorption ratio (SAR) on crop yield and quality under non-saline conditions[a]

Tolerance to SAR and range at which affected	Crop	Growth response under field conditions
Extremely sensitive SAR = 2–8	Avocado Deciduous fruits Nuts Citrus	Leaf tip burn, leaf scorch
Sensitive SAR = 8–18	Beans	Stunted growth
Medium SAR = 18–46	Clover Oats Tall fescue Rice Dallis grass	Stunted growth, possible sodium toxicity, possible calcium or magnesium deficiency
High SAR = 46–102	Wheat Cotton Lucerne Barley Beets Rhodes grass	Stunted growth

a After Pearson (1960); SAR = Sodium Adsorption Ratio (see Section 4.2.4.1)

4.2.6 Heavy metals and metalloids

Long-term trigger values (LTV) and short-term trigger values (STV) for heavy metals and metalloids in irrigation water are presented in table 4.2.10. Concentrations in irrigation water should be less than the recommended trigger values.

Table 4.2.10 Agricultural irrigation water long-term trigger value (LTV), short-term trigger value (STV) and soil cumulative contaminant loading limit (CCL) triggers for heavy metals and metalloids[a]

Element	Suggested soil CCL[b] (kg/ha)	LTV in irrigation water (long-term use — up to 100 yrs) (mg/L)	STV in irrigation water (short-term use — up to 20 yrs) (mg/L)
Aluminium	ND	5	20
Arsenic	20	0.1	2.0
Beryllium	ND	0.1	0.5
Boron	ND	0.5	Refer to table 9.2.18 (Volume 3)
Cadmium	2	0.01	0.05
Chromium	ND	0.1	1
Cobalt	ND	0.05	0.1
Copper	140	0.2	5
Fluoride	ND	1	2
Iron	ND	0.2	10
Lead	260	2	5
Lithium	ND	2.5 (0.075 Citrus crops)	2.5 (0.075 Citrus crops)
Manganese	ND	0.2	10
Mercury	2	0.002	0.002
Molybdenum	ND	0.01	0.05
Nickel	85	0.2	2
Selenium	10	0.02	0.05
Uranium	ND	0.01	0.1
Vanadium	ND	0.1	0.5
Zinc	300	2	5

a Trigger values should only be used in conjunction with information on each individual element and the potential for off-site transport of contaminants (Volume 3, Section 9.2.5)

b ND = Not determined; insufficient background data to calculate CCL

Table 4.2.11 Agricultural irrigation water long-term trigger value (LTV) and short-term trigger value (STV) guidelines for nitrogen and phosphorus

Element	LTV in irrigation water (long-term — up to 100 yrs) (mg/L)	STV in irrigation water (short-term — up to 20 yrs) (mg/L)
Nitrogen	5	25–125 [a]
Phosphorus	0.05 (To minimise bioclogging of irrigation equipment only)	0.8–12 [a]

a Requires site-specific assessment (see Section 9.2.6)

The concepts of long-term trigger value (LTV) and short-term trigger value (STV) developed for metals and metalloids have also been used to develop guidelines for phosphorus (P) and nitrogen (N).

Excess quantities of N can lead to leaching of N into groundwater and surface water, over-stimulation of plant growth (decreasing yields) and stimulation of algal growth in surface water. The LTV for nitrogen has been set at a concentration low enough to ensure no decreases in crop yields or quality occur. The STV range for nitrogen has been set to minimise the risk of contaminating groundwater and surface water and requires site-specific information[a] which considers the crop that is being grown, environmentally significant concentrations, and gaseous losses.

a See Section 9.2.6

Phosphorus is often the nutrient that stimulates rapid growth of many microorganisms (i.e. algal blooms). The LTV for P has been set to prevent algal growth in irrigation water. The STV range for P has been set as an interim range due to the limited data currently available. Calculation of the interim range considers the fertiliser value of phosphorus in water, the phosphorus removed from irrigation sites through harvest, fertiliser inputs, and phosphorus sorption/retention capacities of soils.[b]

b An interim method of calculating a site-specific STV is outlined in Section 9.2.6

The trigger values provided in table 4.2.11 should only be used in conjunction with the discussion contained in Volume 3, Section 9.2.6.

4.2.8 Pesticides

Trigger values for pesticides in irrigation water are listed in table 4.2.12. They consider likely adverse effects of herbicides on crop growth but do not consider potential impacts on aquatic ecosystems. They are based on relatively limited information and include only a subset of herbicides (and no other pesticides) that might be found in irrigation waters.

4.2.9 Radiological quality of irrigation water

Trigger values for the radiological quality of agricultural waters are given in table 4.2.13.

Radioactive contaminants can originate from both natural and artificial sources and can potentially be found in surface waters and groundwaters. The main risks to human health due to radioactivity in irrigation water arise from the transfer of radionuclides to crop and animal products for human consumption. Cancer is a potential health hazard for humans associated with exposure to radionuclides in irrigation water.

Table 4.2.13 Trigger values for radioactive contaminants for irrigation water

Radionuclide	Trigger concentration
Radium 226	5 Bq/L
Radium 228	2 Bq/L
Uranium 238	0.2 Bq/L
Gross alpha	0.5 Bq/L
Gross beta (excluding K-40)	0.5 Bq/L

4.2.10 General water uses

4.2.10.1 pH

To limit corrosion and fouling of pumping, irrigation and stock watering systems, pH should be maintained between 6 and 8.5 for groundwater systems and between 6 and 9 for surface water systems.

The pH of water is a measure of its acidity or alkalinity. Generally, pH itself is not a water quality issue of concern, but it can indicate the presence of a number of related problems. The greatest hazard with high or low pH is the potential for deterioration as a result of corrosion or fouling. Values between 4 and 6 should be regarded with caution and a pH >6 should be maintained to reduce the potential for corrosion. The upper pH limit for groundwaters should be slightly lower than for surface waters because of the increased potential for encrustation and fouling. Soil and animal health will not generally be affected by water with pH in the range of 4–9.

4.2.10.2 Corrosion

Trigger values for assessing the corrosiveness of water are given in table 4.2.14.

Table 4.2.14 Corrosion potential of waters on metal surfaces as indicated by pH, hardness, Langelier index, Ryznar index and the log of chloride:carbonate ratio

Parameter[a]	Value	Comments
pH	<5 5 to 6 >6	High corrosion potential Likelihood of corrosion Limited corrosion potential
Hardness	<60 mg/L CaCO3	Increased corrosion potential
Langelier Index	<-0.5 -0.5 to 0.5	Increased corrosion potential Limited corrosion potential
Ryznar Index	<6 >7	Limited corrosion potential Increased corrosion potential
Log of chloride to carbonate ratio	>2	Increased corrosion potential

a For further information on these parameters refer to Volume 3, Section 9.2.9.1

Corrosion of pumping, irrigation and stock watering equipment is a common problem in many agricultural areas of Australia, particularly where groundwater sources are used. It often results in the deterioration of well and pumping equipment, pipelines, channels, sprinkler devices and storage tanks, leading to decreased or uneven water distribution. Corrosion can be caused by chemical, physical or microbiological processes acting on metal surfaces in contact with