Oxoacids of Chlorine and their Salts

These guidelines refer only to the oxidising ability of the chemicals and their ability to release chlorine gas or chlorine oxides. For other hazards with these materials, users should refer to the SDS for the chemical or other reputable sources.

All of these compounds should be handled in a well ventilated fume cupboard. Preparations for dealing with spills should be completed. Acidification should be avoided as far as possible. When necessary, it should be done in a controlled manner. Mixing with organic materials should also only be done in a carefully controlled manner.

PPE should be worn: safety glasses, lab coat, long pants, covered shoes and gloves when appropriate. When the mixture being handled is potentially explosive, the use of a safety shield should be considered.

The sodium salts are listed below, as these are the most commonly used. Salts of related metals should be considered to be similar.

Sodium hypochlorite (bleach) NaOCl
Concentrated solutions of NaOCl are considered to be hazardous oxidizing agents and should only be used under carefully controlled circumstances. This does not apply to commercial bleach.
Acidification of bleach, including commercial bleach, will release chlorine gas.
NaOCl can react with primary amines to form unstable and explosive *N*-chloroamines. Such reactions should be carried out only under carefully controlled conditions.
Excess bleach may be destroyed by use of a reducing agent such as sodium sulfite.

Sodium chlorite $NaClO_2$
$NaClO_2$ is an oxidizing substance and should only be mixed with organic compounds or other oxidisable substances under carefully controlled conditions. $NaClO_2$ may explode upon impact. Acidification of $NaClO_2$ should be avoided as it produces the unstable $HClO_2$.
$NaClO_2$ has also been reported to be impact sensitive and should be handled with due care.

Sodium chlorate $NaClO_3$
Mixtures of chlorate salts with organic compounds are likely to be explosive. Contact between chlorates and organic materials should only be under carefully controlled conditions.
Acidification of chlorate salts will release the highly unstable and oxidizing chloric acid.

Sodium perchlorate $NaClO_4$ and perchloric acid $HClO_4$
Perchlorate salts are powerful oxidants. Contact with organic materials should be avoided if possible, and limited when it cannot be avoided. This is because explosive organic perchlorates may be formed.

New perchlorate salts
The perchlorate ion is often employed as a "non-nucleophilic" anion or as a weakly coordinating ligand. Other anions, such as tetrafluoroborate, triflate or hexafluoroantimonate should be considered. If perchlorate is used, a maximum amount of material that can be handled should be included in a specific risk assessment. Use of a safety shield is recommended.

New perchlorates may have unexpected properties , especially in terms of shock sensitivity or compatibility. Such compounds should first be prepared on a milligram scale. Shock and thermal stability testing should be carried out before the procedure is scaled up.

Perchloric acid
Perchloric acid is a strong acid and a powerful oxidizing agent, especially with heating. Before perchloric acid is used, other strong acids, such as triflic acid CF_3SO_3H, should be considered as alternatives. Advice on the use of perchloric acid can be found in *J. Chem. Ed.* **1972**, *49*, A463. This must be consulted before $HClO_4$ is used. It is available online via the NTU library:
http://pubs.acs.org.ezlibproxy1.ntu.edu.sg/doi/pdf/10.1021/ed049pA463.

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