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ABSTRACT: Over the last few decades, multiplier ideals and their associated jumping numbers have become an important topic in the field of birational geometry of complex algebraic varieties and in singularity theory. In this PhD Thesis we describe the multiplier ideals and the jumping numbers associated with an irreducible germ of quasi-ordinary hypersurface and also with a plane curve singularity. The approach is motivated by a theorem of Howald describing multiplier ideals a Newton non-degenerate hypersurface singularity in terms of a Newton polyhedron. We prove a version of Howald’s result by using that one has toroidal embedded resolutions for these singularities. The structure of these resolutions is determined by the embedded topological type. The method passes by a precise description of the generating sequences associated with the divisorial valuations associated with the exceptional prime divisors appearing in their toroidal embedded resolutions. The main result in both cases is that multiplier ideals are generated by generalized monomials in the maximal contact curves, also called semi-roots, and their generalizations in the quasi-ordinary hypersurface case. As an application of this study, we obtain algorithms to compute basis of the multiplier ideals and the set of jumping numbers.