

## 1.0

# INTRODUCTION

## 1.1 BACKGROUND

Metal welding, cutting and spraying operations are sources of a variety of air pollutants, including some that have been designated as toxic air contaminants under the Air Toxics “Hot Spots” Information and Assessment Act of 1987 (AB 2588) and South Coast Air Quality Management District (AQMD) Rules 1401 and 1402, and hazardous air pollutants (HAPs) under Title III of the 1990 Amendments to the Clear Air Act. In assessing the risks to the general public of emissions from these operations, the AQMD is in the process of improving its emission inventory for toxic metals such as hexavalent chromium, nickel, lead, zinc, and cadmium. The purpose of this contract was to conduct a survey of facilities in standard industrial classification (SIC) codes 3310 - 3899; determine the types of metal welding, cutting and spraying operations that are conducted within this group; and to develop a more refined inventory for the toxic metals chromium, nickel, lead, zinc, and cadmium.

## 1.2 METAL WELDING, CUTTING, AND SPRAYING

Metal welding is the process of joining metal pieces together and filling the joint with molten metal. Facilities in the range of SIC codes of interest use a large variety of different processes that involve metal welding, arc welding, resistance welding, brazing, soldering, and oxyfuel welding. Metal cutting is generally accomplished with an oxygen based flame or a high temperature electric arc. Metal spraying is conducted by melting metal wire or mixing metal powder within a high temperature flame or plasma and spraying the molten metal onto the component. The above operations are conducted with either manually operated equipment, or sophisticated robotic/automated techniques used in high volume repetitive production operations. Appendix B provides complete descriptions for the most common welding, metal cutting, and metal spraying processes.

## 1.3 OBJECTIVES

The objectives of this study, which was performed by Pacific Environmental Services, Inc. (PES) were to:

- (1) Identify and evaluate emission factors (with and without control equipment) for hexavalent chromium, nickel and nickel compounds, lead, cadmium and zinc released by metal welding, cutting and spraying operations;
- (2) Identify the number and types of metal welding, cutting and spraying operations in the jurisdiction of the AQMD; and
- (3) Develop a comprehensive industrywide emission inventory covering metal welding, cutting and spraying operations in the AQMD.

## 1.4 OVERVIEW OF THE PROJECT

A survey form was developed and mailed to industrial and manufacturing facilities that used metal welding, cutting and spraying processes. The purpose of the survey was to determine the frequency of occurrence of procedures and operating parameters; methods of air pollution control; and the amount of consumables (wire, electrodes, powder, metal containing fluxes, etc) used. Industries targeted included primary metal industries; fabricated metal manufacturing; industrial and commercial machinery manufacturing; and manufacturers of electronic and electrical equipment, transportation equipment, and instruments and related products. The survey did *not* include construction firms or other firms that conduct welding off their own premises. The contractor determined that there were about 12,078 facilities within the named SIC codes in Los Angeles, Orange, Riverside and San Bernardino counties. A sample of facilities from these SIC codes was surveyed and the survey findings were generalized to the AQMD as a whole.

Survey instruments (cover letter, questionnaire, etc) were designed. Names and addresses were obtained from a commercial mailing list company, and survey packages were mailed in batches by a mailing house. Follow-up telephone calls were made to facilities that were sent survey forms but did not respond, or provided incomplete or confusing information. Survey data were compiled into a relational database that included information on the type of manufacturing; methods used in welding, cutting and spraying; quantities and composition of consumables used; and time spent welding and/or cutting.

In parallel with the survey, the contractor developed emission factors to be used in conjunction with the reported activity data to estimate emissions of chromium, lead, nickel and zinc. It was necessary to reorganize welding emission factors in the U.S. Environmental Protection Agency's *AP-42, Compilation of Air Pollutant Emission Factors* (USEPA, 1995) into a format useful for this project. Emission factors for metal cutting were obtained from the research literature and source test data. Finally, metal spraying emission factors were developed from the results of several source tests conducted in the AQMD and San Diego County.<sup>1</sup>

Using the emission factors developed and/or reorganized for the project, the contractor calculated emissions of chromium, lead, nickel and zinc for the survey respondents. These emissions were then generalized to the AQMD as a whole.

## 1.5 ORGANIZATION OF THE REPORT

Development of emission factors for metal welding, cutting and spraying is described in Section 2. Section 3 covers the survey methodology. Section 4 describes the emission inventory methods and Section 5 presents the results of the survey and the emission inventory calculations. Section 6 is a discussion of significant findings and uncertainties in the inventory. Section 7 contains the conclusions and recommendations. Ref-

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<sup>1</sup> No emissions tests were conducted under this contract.

ferences cited are listed in Section 8. Appendix A contains the survey instruments and Appendix B describes common metal welding, cutting and spraying processes.