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INTERNATIONAL PLATINUM GROUP METALS ASSOCIATION

SAFE USE OF PLATINUM GROUP METALS IN THE WORKPLACE

AUTHORSHIP

THIS GUIDE WAS DEVELOPED BY THE PGM SCIENCE TASK FORCE OF THE INTERNATIONAL PLATINUM GROUP METALS ASSOCIATION (IPA). IPA IS A NON-PROFIT ASSOCIATION REPRESENTING THE WORLD'S LEADING MINING, PRODUCTION AND FABRICATION COMPANIES IN THE GLOBAL PLATINUM GROUP METALS (PGMS) INDUSTRY, COMPRISING PLATINUM, PALLADIUM, IRIDIUM, RHODIUM, OSMIUM AND RUTHENIUM.

THE IPA PGM SCIENCE TASK FORCE WAS SET UP TO PROMOTE CONSENSUS ON SAFE HANDLING PRACTICES FOR PGMS IN THE WORKPLACE. ITS WORK INCLUDES THE DEVELOPMENT OF ROBUST METHODS FOR MEASURING EXPOSURES TO PLATINUM SPECIES, FURTHERING THE UNDERSTANDING OF EXPOSURE-RESPONSE RELATIONSHIPS FOR CHLOROPLATINATE-INDUCED ALLERGY, AND THE SELECTION OF APPROPRIATE CONTROL MEASURES.

THE RESULTS OF THIS PROGRAM ARE REFLECTED IN THIS GUIDANCE DOCUMENT COVERING THE HEALTH PROTECTION OF WORKERS EXPOSED TO PGMS.

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INTRODUCTION AND EXECUTIVE SUMMARY

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INTRODUCTION: ABOUT THIS GUIDE

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To advance scientific knowledge on the platinum group metals (PGMs)—and particularly to promote their safe handling—the Science Task Force (STF) of the International Platinum Group Metals Association (IPA) has prepared a new publication: ***Safe Use of Platinum Group Metals in the Workplace***. This Guide has been released as part of a series of continuous improvement measures being voluntarily undertaken within the PGM sector, which are intended to cover both producers and product end-users.

The main objectives of the Guide are to identify the key hazards and risks associated with occupational exposures to PGMs, and to suggest possible components of a comprehensive occupational health programme for worker protection. Emphasis has been given to highlighting improvement opportunities for the proper control of certain soluble complex salts of platinum which are respiratory sensitisers (may cause occupational asthma).

This Guide has primarily been written for those professionals who are responsible for the health protection of workers exposed to PGM substances or PGM-containing materials, including occupational physicians, nurses, industrial hygienists, safety engineers, and other health and safety specialists. It will also be relevant to those responsible for the day to day operation of facilities, including operational and business managers.

As with all scientific publications, the information contained within this Guide is subject to change as further knowledge emerges, and future updates are envisaged. It should be noted that while it is comprehensive in its coverage, the Guide is not intended to be relied upon as a definitive or exhaustive source—readers are encouraged to obtain further information, such as that available in supplier safety datasheets.

This Guide has been prepared by independent consultants in collaboration with specialists within the member companies of the IPA. Independent expert peer reviews and opinions have also been obtained. While all reasonable care has been taken in the preparation of this Guide, neither the consultants, reviewers, IPA, nor any of its members nor respective officers, directors, or employees, or those of their subsidiaries, accepts responsibility or liability in relation to the accuracy or completeness of this Guide.

Readers/users of the Guide are requested to bring to the attention of the IPA Science Task Force (STF) any new information or publications, or errors in the text which may be relevant to its content (science@ipa-news.com). It should be noted that this Guide constitutes just one part of a comprehensive outreach programme undertaken by the IPA aimed at encouraging exemplary workplace stewardship of PGMs. In turn, the ultimate objective of this raft of voluntary initiatives by the PGM sector is to keep employees working with PGMs healthy, and also to reduce specific and overall risks in the work environment. Hence the IPA Science Task Force (STF) welcomes approaches by individuals or organisations with interests in this area or new information.
Contact: science@ipa-news.com

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Six elements of Groups 8, 9, and 10 in the periodic table constitute the platinum group metals (PGMs): platinum (Pt), palladium (Pd), rhodium (Rh), ruthenium (Ru), iridium (Ir), and osmium (Os). In historic terms, the health effect of greatest concern in relation to human exposure to PGMs has been respiratory sensitisation in the workplace—which has almost exclusively been confined to workers exposed to certain compounds of Pt known as complex halogenated platinum salts (CHPS). This phenomenon has commonly been referred to as **platinum salt sensitivity** (PSS); also known as platinum salt sensitisation. Workers exposed to other platinum species, or to other PGMs, have shown little or no evidence of such an effect.

The first reliably documented study of respiratory sensitisation to CHPS occurred in the early-1900s. Since that time, numerous studies conducted on workers exposed to CHPS have established the characteristics of *symptomatic* PSS, which may present as conjunctivitis and/or rhinitis in its early stages, progressing to more serious occupational asthma in workers with continued exposures to CHPS. Due to a long-standing awareness of PSS, considerable efforts have been made within the platinum industry to reduce exposures to CHPS and otherwise limit PSS occurrence, resulting in marked decreases in its incidence. Nevertheless, CHPS-respiratory sensitisation remains a cause for concern in certain occupational settings.

This Guide—the ***Safe Use of Platinum Group Metals in the Workplace***—has been prepared to describe the potential hazards of occupational exposures to PGMs, to assist those responsible for the health protection of workers exposed to CHPS and other PGMs.

The Guide is organised into two main sections. Chapters 2 through 6 provide background information on the PGMs including physical and chemical properties, and inform the reader about the potential health hazards associated with workplace exposures to certain platinum compounds. Chapters 7 through 10 are instructive in nature, providing examples and suggestions for consideration in the design and implementation of occupational health and safety programmes for worker protection (including best practices). As such, they cover medical surveillance, workplace monitoring, management systems within the workplace (including industrial hygiene practices and worker training), and regulatory standards and communication.

For ease of use, all chapters begin with summaries describing the main themes discussed in each chapter. The themes are as follows:

CHAPTER 2

Chapter 2 discusses the physical and chemical properties of PGM substances. Differences between simple and complex compounds are highlighted. This chapter underpins how these properties in turn relate to the commercial applications of PGMs, as well as to their toxicity.

CHAPTER 3

Chapter 3 discusses production and uses of the PGMs: where they are found, how they are extracted and refined, how primary recovery differs from secondary recovery,

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and the many useful applications and benefits PGMs confer on society. Attention is given to the special catalytic properties of PGMs which make them widely used in important industrial applications. Uses in healthcare and other products are also described.

CHAPTER 4

In Chapter 4, there is qualitative coverage of the main sources of exposure to PGMs and their compounds, including where exposure to CHPS, such as chloroplatinates, may occur.

CHAPTER 5

Chapter 5 focuses on the toxicokinetics of PGMs, i.e., from initial consideration of routes of exposure, how they are absorbed, the pattern of their tissue and organ distribution, and the means by which they are eliminated (excreted). Its content sets the scene for the subsequent discussion in Chapter 6 of the potential health effects of PGMs. The utility of biological monitoring is discussed.

CHAPTER 6

The background chapters are completed by Chapter 6, in which the major potential health effects from exposures to PGMs are discussed. The chapter mainly focuses on the respiratory sensitisation of certain platinum species as this health effect is particularly relevant to occupational exposures and, thus far, constitutes the effect of most concern. It clearly delineates between those platinum species which are known respiratory sensitisers and those which have not been shown to have this property—this topic is addressed in depth due to certain misconceptions which exist about the sensitising forms. A detailed discussion of the mode of action pertaining to immune sensitisation is provided. The current knowledge on the mode of action for platinum salt sensitivity (PSS) is reviewed. Health effects for other Pt series substances are summarised. To conclude the chapter, the toxicity profiles of non-platinum PGMs are briefly discussed.

CHAPTER 7

Chapter 7, as the first of the instructive sequence of chapters, provides information pertaining to the medical surveillance of workers. In particular, guidance is given on optimal methods for investigating and diagnosing PSS. Descriptions are given of procedures such as standardised questionnaires, together with tests for determining immunological responses (in particular the skin prick test), and for respiratory function. The steps that need to be undertaken in designing a medical surveillance programme are outlined and discussed, including: pre-placement examinations, periodic and termination/post-termination assessments; criteria for employment and diagnosis of disease; and the management of workers with confirmed PSS. Treatment and prognosis are briefly summarised.

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CHAPTER 8

Chapter 8 serves as a counterpart to Chapter 7, covering workplace surveillance (workplace monitoring). Many important facets of an air monitoring programme are discussed. Detailed advice and recommendations are made with respect to sampling strategies and techniques, monitoring frequency, selection of equipment, sample analysis, and documentation and record keeping. The chapter is meant to aid in the design of a comprehensive, well-executed workplace surveillance programme for monitoring worker exposures to PGMs and related workplace contaminants.

CHAPTER 9

Chapter 9 concentrates on control measures and safe management systems. As most PGMs are integral to the workplaces being considered, and typically cannot be eliminated or readily substituted, the chapter focuses on practical measures to reduce exposures. These include the use of containment and other engineering controls, changing the way employees go about their work (administrative controls), selection and use of personal protective equipment (PPE), and optimal hygienic workplace practices. There is emphasis on the proper integration of exposure monitoring, and the importance of worker awareness and training.

CHAPTER 10

The last chapter of the Guide (Chapter 10) summarises regulatory controls and other standards that may be applicable to proper workplace control of PGMs, together with systems for worker hazard communication. These are illustrated by various territorial examples of chemical risk assessment standards, occupational exposure limits for PGM substances, hazard communication and chemical labelling requirements, chemical safety datasheets (SDS) and other benchmark control values.