

## APPENDIX A

### Abbreviations and Units of Measure

1 carat (metric) (diamond)	= 200 milligrams
1 flask (fl)	= 76 pounds, avoirdupois
1 karat (gold)	= one twenty-fourth part
1 kilogram (kg)	= 2.2046 pounds, avoirdupois
1 long ton (lt)	= 2,240 pounds, avoirdupois
1 long ton unit (ltu)	= 1% of 1 long ton or 22.4 pounds avoirdupois
long calcined ton (lct)	= excludes water of hydration
long dry ton (ldt)	= excludes excess free moisture
Mcf	= 1,000 cubic feet
1 metric ton (t)	= 2,204.6 pounds, avoirdupois or 1,000 kilograms
1 metric ton (t)	= 1.1023 short ton
1 metric ton unit (mtu)	= 1% of 1 metric ton or 10 kilograms
1 pound (lb)	= 453.6 grams
1 short ton (st)	= 2,000 pounds, avoirdupois
1 short ton unit (stu)	= 1% of 1 short ton or 20 pounds, avoirdupois
1 short dry ton (sdt)	= 2,000 pounds, avoirdupois, excluding moisture content
1 troy ounce (tr oz)	= 1.09714 avoirdupois ounces or 31.103 grams
1 troy pound	= 12 troy ounces

## APPENDIX B

### Definitions of Selected Terms Used in This Report

#### Terms Used for Materials in the National Defense Stockpile and Helium Stockpile

**Uncommitted inventory** refers to the quantity of mineral materials held in the National Defense Stockpile. Nonstockpile-grade materials may be included in the table; where significant, the quantities of these stockpiled materials will be specified in the text accompanying the table.

**Committed inventory** refers to materials that have been sold or traded from the stockpile, either in the current fiscal year (FY 2005) or in prior years, but not yet removed from stockpile facilities as of September 30, 2005.

**Authorized for disposal** refers to quantities that are in excess of the stockpile goal for a material, and for which Congress has authorized disposal over the long term at rates designed to maximize revenue but avoid undue disruption of the usual markets and financial loss to the United States.

**Disposal plan FY 2005** indicates the total amount of a material in the National Defense Stockpile that the U.S. Department of Defense is permitted to sell under the Annual Materials Plan approved by Congress for the fiscal year. Fiscal year 2005 is the period October 1, 2004, through September 30, 2005. For mineral commodities that have a disposal plan greater than the inventory, actual quantity will be limited to remaining disposal authority or inventory. Note that, unlike the National Defense Stockpile, helium stockpile sales by the Bureau of Land Management under the Helium Privatization Act of 1996 are permitted to exceed disposal plans.

**Disposals FY 2005** refers to material sold or traded from the stockpile in fiscal year 2005.

#### Depletion Allowance

The depletion allowance is a business tax deduction analogous to depreciation, but applies to an ore reserve rather than equipment or production facilities. Federal tax law allows this deduction from taxable corporate income, recognizing that an ore deposit is a depletable asset that must eventually be replaced.

## APPENDIX C

# A Resource/Reserve Classification for Minerals<sup>1</sup>

### INTRODUCTION

Through the years, geologists, mining engineers, and others operating in the minerals field have used various terms to describe and classify mineral resources, which as defined herein include energy materials. Some of these terms have gained wide use and acceptance, although they are not always used with precisely the same meaning.

The U.S. Geological Survey (USGS) collects information about the quantity and quality of all mineral resources. In 1976, the USGS and the U.S. Bureau of Mines developed a common classification and nomenclature, which was published as USGS Bulletin 1450-A—*“Principles of the Mineral Resource Classification System of the U.S. Bureau of Mines and U.S. Geological Survey.”* Experience with this resource classification system showed that some changes were necessary in order to make it more workable in practice and more useful in long-term planning. Therefore, representatives of the USGS and the U.S. Bureau of Mines collaborated to revise Bulletin 1450-A. Their work was published in 1980 as USGS Circular 831—*“Principles of a Resource/Reserve Classification for Minerals.”*

Long-term public and commercial planning must be based on the probability of discovering new deposits, on developing economic extraction processes for currently unworkable deposits, and on knowing which resources are immediately available. Thus, resources must be continuously reassessed in the light of new geologic knowledge, of progress in science and technology, and of shifts in economic and political conditions. To best serve these planning needs, known resources should be classified from two standpoints: (1) purely geologic or physical/chemical characteristics—such as grade, quality tonnage, thickness, and depth—of the material in place; and (2) profitability analyses based on costs of extracting and marketing the material in a given economy at a given time. The former constitutes important objective scientific information of the resource and a relatively unchanging foundation upon which the latter more valuable economic delineation can be based.

The revised classification system, designed generally for all mineral materials, is shown graphically in figures 1 and 2; its components and their usage are described in the text. The classification of mineral and energy resources is necessarily arbitrary, because definitional criteria do not always coincide with natural boundaries. The system can be used to report the status of mineral and energy-fuel resources for the Nation or for specific areas.

### RESOURCE/RESERVE DEFINITIONS

A dictionary definition of resource, “something in reserve or ready if needed,” has been adapted for mineral and energy resources to comprise all materials,

including those only surmised to exist, that have present or anticipated future value.

**Resource.**—A concentration of naturally occurring solid, liquid, or gaseous material in or on the Earth’s crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible.

**Original Resource.**—The amount of a resource before production.

**Identified Resources.**—Resources whose location, grade, quality, and quantity are known or estimated from specific geologic evidence. Identified resources include economic, marginally economic, and sub-economic components. To reflect varying degrees of geologic certainty, these economic divisions can be subdivided into measured, indicated, and inferred.

**Demonstrated.**—A term for the sum of measured plus indicated.

**Measured.**—Quantity is computed from dimensions revealed in outcrops, trenches, workings, or drill holes; grade and(or) quality are computed from the results of detailed sampling. The sites for inspection, sampling, and measurements are spaced so closely and the geologic character is so well defined that size, shape, depth, and mineral content of the resource are well established.

**Indicated.**—Quantity and grade and(or) quality are computed from information similar to that used for measured resources, but the sites for inspection, sampling, measurement are farther apart or are otherwise less adequately spaced. The degree of assurance, although lower than that for measured resources, is high enough to assume continuity between points of observation.

**Inferred.**—Estimates are based on an assumed continuity beyond measured and(or) indicated resources, for which there is geologic evidence. Inferred resources may or may not be supported by samples or measurements.

**Reserve Base.**—That part of an identified resource that meets specified minimum physical and chemical criteria related to current mining and production practices, including those for grade, quality, thickness, and depth. The reserve base is the in-place demonstrated (measured plus indicated) resource from which reserves are estimated. It may encompass those parts of the resources that have a reasonable potential for becoming economically available within planning horizons beyond those that assume proven technology and current economics. The reserve base includes those resources that are currently economic (reserves), marginally economic (marginal reserves), and some of those that are currently subeconomic (subeconomic resources). The term “geologic reserve” has been applied by others generally to the reserve-base category, but it

<sup>1</sup>Based on U.S. Geological Survey Circular 831, 1980.

also may include the inferred-reserve-base category; it is not a part of this classification system.

**Inferred Reserve Base.**—The in-place part of an identified resource from which inferred reserves are estimated. Quantitative estimates are based largely on knowledge of the geologic character of a deposit and for which there may be no samples or measurements. The estimates are based on an assumed continuity beyond the reserve base, for which there is geologic evidence.

**Reserves.**—That part of the reserve base which could be economically extracted or produced at the time of determination. The term reserves need not signify that extraction facilities are in place and operative. Reserves include only recoverable materials; thus, terms such as “extractable reserves” and “recoverable reserves” are redundant and are not a part of this classification system.

**Marginal Reserves.**—That part of the reserve base which, at the time of determination, borders on being economically producible. Its essential characteristic is economic uncertainty. Included are resources that would be producible, given postulated changes in economic or technological factors.

**Economic.**—This term implies that profitable extraction or production under defined investment assumptions has been established, analytically demonstrated, or assumed with reasonable certainty.

**Subeconomic Resources.**—The part of identified resources that does not meet the economic criteria of reserves and marginal reserves.

**Undiscovered Resources.**—Resources, the existence of which are only postulated, comprising deposits that are separate from identified resources. Undiscovered resources may be postulated in deposits of such grade and physical location as to render them economic, marginally economic, or subeconomic. To reflect varying degrees of geologic certainty, undiscovered resources may be divided into two parts:

**Hypothetical Resources.**—Undiscovered resources that are similar to known mineral bodies and that may be reasonably expected to exist in the same producing district or region under analogous geologic conditions. If exploration confirms their

existence and reveals enough information about their quality, grade, and quantity, they will be reclassified as identified resources.

**Speculative Resources.**—Undiscovered resources that may occur either in known types of deposits in favorable geologic settings where mineral discoveries have not been made, or in types of deposits as yet unrecognized for their economic potential. If exploration confirms their existence and reveals enough information about their quantity, grade, and quality, they will be reclassified as identified resources.

**Restricted Resources/Reserves.**—That part of any resource/reserve category that is restricted from extraction by laws or regulations. For example, restricted reserves meet all the requirements of reserves except that they are restricted from extraction by laws or regulations.

**Other Occurrences.**—Materials that are too low grade or for other reasons are not considered potentially economic, in the same sense as the defined resource, may be recognized and their magnitude estimated, but they are not classified as resources. A separate category, labeled other occurrences, is included in figures 1 and 2. In figure 1, the boundary between subeconomic and other occurrences is limited by the concept of current or potential feasibility of economic production, which is required by the definition of a resource. The boundary is obviously uncertain, but limits may be specified in terms of grade, quality, thickness, depth, percent extractable, or other economic-feasibility variables.

**Cumulative Production.**—The amount of past cumulative production is not, by definition, a part of the resource. Nevertheless, a knowledge of what has been produced is important to an understanding of current resources, in terms of both the amount of past production and the amount of residual or remaining in-place resource. A separate space for cumulative production is shown in figures 1 and 2. Residual material left in the ground during current or future extraction should be recorded in the resource category appropriate to its economic-recovery potential.

**FIGURE 1.—Major Elements of Mineral-Resource Classification, Excluding Reserve Base and Inferred Reserve Base**

Cumulative Production	IDENTIFIED RESOURCES		UNDISCOVERED RESOURCES		
	Demonstrated		Inferred	Probability Range	
	Measured	Indicated		Hypothetical	(or) Speculative
ECONOMIC	Reserves		Inferred Reserves	+	
MARGINALLY ECONOMIC	Marginal Reserves		Inferred Marginal Reserves		
SUBECONOMIC	Demonstrated Subeconomic Resources		Inferred Subeconomic Resources		
Other Occurrences	Includes nonconventional and low-grade materials				

**FIGURE 2.—Reserve Base and Inferred Reserve Base Classification Categories**

Cumulative Production	IDENTIFIED RESOURCES		UNDISCOVERED RESOURCES		
	Demonstrated		Inferred	Probability Range	
	Measured	Indicated		Hypothetical	(or) Speculative
ECONOMIC	Reserve		Inferred	+	
MARGINALLY ECONOMIC	Base		Reserve		
SUBECONOMIC	Base		Base		
Other Occurrences	Includes nonconventional and low-grade materials				

**APPENDIX D****Country Specialists Directory**

Minerals information country specialists at the U.S. Geological Survey collect and analyze information on the mineral industries of more than 170 nations throughout the world. The specialists are available to answer minerals-related questions concerning individual countries.

**Africa and the Middle East**

Algeria Philip M. Mobbs  
 Angola Omayra Bermúdez-Lugo  
 Bahrain Philip M. Mobbs  
 Benin Omayra Bermúdez-Lugo  
 Botswana Philip M. Mobbs  
 Burkina Faso Omayra Bermúdez-Lugo  
 Burundi Thomas R. Yager  
 Cameroon Omayra Bermúdez-Lugo  
 Cape Verde Omayra Bermúdez-Lugo  
 Central African Republic Omayra Bermúdez-Lugo  
 Chad Philip M. Mobbs  
 Comoros Thomas R. Yager  
 Congo (Brazzaville) Philip M. Mobbs  
 Congo (Kinshasa) Thomas R. Yager  
 Côte d'Ivoire Omayra Bermúdez-Lugo  
 Cyprus Philip M. Mobbs  
 Djibouti Thomas R. Yager  
 Egypt Harold R. Newman  
 Equatorial Guinea Philip M. Mobbs  
 Eritrea Thomas R. Yager  
 Ethiopia Thomas R. Yager  
 Gabon Omayra Bermúdez-Lugo  
 The Gambia Omayra Bermúdez-Lugo  
 Ghana Omayra Bermúdez-Lugo  
 Guinea Omayra Bermúdez-Lugo  
 Guinea-Bissau Omayra Bermúdez-Lugo  
 Iran Philip M. Mobbs  
 Iraq Philip M. Mobbs  
 Israel Thomas R. Yager  
 Jordan Thomas R. Yager  
 Kenya Thomas R. Yager  
 Kuwait Philip M. Mobbs  
 Lebanon Thomas R. Yager  
 Lesotho Thomas R. Yager  
 Liberia Omayra Bermúdez-Lugo  
 Libya Philip M. Mobbs  
 Madagascar Thomas R. Yager  
 Malawi Thomas R. Yager  
 Mali Omayra Bermúdez-Lugo  
 Mauritania Omayra Bermúdez-Lugo  
 Mauritius Thomas R. Yager  
 Morocco & Western Sahara Omayra Bermúdez-Lugo  
 Mozambique Thomas R. Yager  
 Namibia Philip M. Mobbs  
 Niger Omayra Bermúdez-Lugo  
 Nigeria Philip M. Mobbs  
 Oman Philip M. Mobbs  
 Qatar Philip M. Mobbs  
 Reunion Thomas R. Yager  
 Rwanda Thomas R. Yager  
 São Tomé & Príncipe Omayra Bermúdez-Lugo  
 Saudi Arabia Philip M. Mobbs  
 Senegal Omayra Bermúdez-Lugo  
 Seychelles Thomas R. Yager  
 Sierra Leone Omayra Bermúdez-Lugo

Somalia Thomas R. Yager  
 South Africa Thomas R. Yager  
 Sudan Thomas R. Yager  
 Swaziland Thomas R. Yager  
 Syria Thomas R. Yager  
 Tanzania Thomas R. Yager  
 Togo Omayra Bermúdez-Lugo  
 Tunisia Philip M. Mobbs  
 Turkey Philip M. Mobbs  
 Uganda Thomas R. Yager  
 United Arab Emirates Philip M. Mobbs  
 Yemen Philip M. Mobbs  
 Zambia Philip M. Mobbs  
 Zimbabwe Philip M. Mobbs

**Asia and the Pacific**

Afghanistan Travis Q. Lyday  
 Australia Travis Q. Lyday  
 Bangladesh Chin S. Kuo  
 Bhutan Chin S. Kuo  
 Brunei Pui-Kwan Tse  
 Burma Yolanda Fong-Sam  
 Cambodia John C. Wu  
 China Pui-Kwan Tse  
 Christmas Island Travis Q. Lyday  
 Fiji Travis Q. Lyday  
 India Chin S. Kuo  
 Indonesia Pui-Kwan Tse  
 Japan John C. Wu  
 Korea, North John C. Wu  
 Korea, Republic of John C. Wu  
 Laos John C. Wu  
 Malaysia Pui-Kwan Tse  
 Mongolia Pui-Kwan Tse  
 Nepal Chin S. Kuo  
 New Caledonia Travis Q. Lyday  
 New Zealand Travis Q. Lyday  
 Pakistan Travis Q. Lyday  
 Papua New Guinea Travis Q. Lyday  
 Philippines Travis Q. Lyday  
 Singapore Pui-Kwan Tse  
 Solomon Islands Travis Q. Lyday  
 Sri Lanka Chin S. Kuo  
 Taiwan Pui-Kwan Tse  
 Thailand John C. Wu  
 Timor, East Pui-Kwan Tse  
 Tonga Travis Q. Lyday  
 Vanuatu Travis Q. Lyday  
 Vietnam John C. Wu

**Europe and Central Eurasia**

Albania Walter G. Steblez  
 Armenia Richard M. Levine  
 Austria Harold R. Newman  
 Azerbaijan Richard M. Levine

Belarus	Richard M. Levine	<b>North America, Central America, and the Caribbean</b>	
Belgium	Harold R. Newman		
Bosnia and Herzegovina	Walter G. Steblez	Antigua and Barbuda	Omayra Bermúdez-Lugo
Bulgaria	Walter G. Steblez	Aruba	Omayra Bermúdez-Lugo
Croatia	Walter G. Steblez	The Bahamas	Omayra Bermúdez-Lugo
Czech Republic	Walter G. Steblez	Barbados	Omayra Bermúdez-Lugo
Denmark, Faroe Islands, and Greenland		Belize	Steven T. Anderson
Estonia	Chin S. Kuo	Bermuda	Omayra Bermúdez-Lugo
Finland	Chin S. Kuo	Canada	Alfredo C. Gurmendi
France	Chin S. Kuo	Costa Rica	Steven T. Anderson
Georgia	Harold R. Newman	Cuba	Omayra Bermúdez-Lugo
Germany	Richard M. Levine	Dominica	Omayra Bermúdez-Lugo
Greece	Steven T. Anderson	Dominican Republic	Omayra Bermúdez-Lugo
Hungary	Harold R. Newman	El Salvador	Steven T. Anderson
Iceland	Walter G. Steblez	Grenada	Omayra Bermúdez-Lugo
Ireland	Chin S. Kuo	Guadeloupe	Omayra Bermúdez-Lugo
Italy	Harold R. Newman	Guatemala	Steven T. Anderson
Kazakhstan	Harold R. Newman	Haiti	Omayra Bermúdez-Lugo
Kyrgyzstan	Richard M. Levine	Honduras	Steven T. Anderson
Latvia	Richard M. Levine	Jamaica	Omayra Bermúdez-Lugo
Lithuania	Chin S. Kuo	Martinique	Omayra Bermúdez-Lugo
Luxembourg	Chin S. Kuo	Mexico	Ivette E. Torres
Macedonia	Harold R. Newman	Montserrat	Omayra Bermúdez-Lugo
Malta	Harold R. Newman	Netherlands Antilles	Omayra Bermúdez-Lugo
Moldova	Walter G. Steblez	Nicaragua	Steven T. Anderson
Netherlands	Harold R. Newman	Panama	Steven T. Anderson
Norway	Richard M. Levine	St. Kitts and Nevis	Omayra Bermúdez-Lugo
Poland	Harold R. Newman	St. Lucia	Omayra Bermúdez-Lugo
Portugal	Chin S. Kuo	St. Vincent & the Grenadines	Omayra Bermúdez-Lugo
Romania	Walter G. Steblez	Trinidad and Tobago	Omayra Bermúdez-Lugo
Russia	Richard M. Levine		
Serbia and Montenegro	Walter G. Steblez	<b>South America</b>	
Slovakia	Walter G. Steblez	Argentina	Ivette E. Torres
Slovenia	Walter G. Steblez	Bolivia	Steven T. Anderson
Spain	Walter G. Steblez	Brazil	Alfredo C. Gurmendi
Sweden	Harold R. Newman	Chile	Steven T. Anderson
Switzerland	Chin S. Kuo	Colombia	Ivette E. Torres
Tajikistan	Harold R. Newman	Ecuador	Steven T. Anderson
Turkmenistan	Richard M. Levine	French Guiana	Yolanda Fong-Sam
Ukraine	Richard M. Levine	Guyana	Yolanda Fong-Sam
United Kingdom	Richard M. Levine	Paraguay	Yolanda Fong-Sam
Uzbekistan	Harold R. Newman	Peru	Alfredo C. Gurmendi
	Richard M. Levine	Suriname	Yolanda Fong-Sam
		Uruguay	Yolanda Fong-Sam
		Venezuela	Ivette E. Torres

**Country specialist**

Steven T. Anderson  
 Omayra Bermúdez-Lugo  
 Yolanda Fong-Sam  
 Alfredo C. Gurmendi  
 Chin S. Kuo  
 Richard M. Levine  
 Travis Q. Lyday  
 Philip M. Mobbs  
 Harold R. Newman  
 Walter G. Steblez  
 Ivette E. Torres  
 Pui-Kwan Tse  
 John C. Wu  
 Thomas R. Yager

**Telephone**

(703) 648-7744  
 (703) 648-4946  
 (703) 648-7756  
 (703) 648-7745  
 (703) 648-7748  
 (703) 648-7741  
 (703) 648-7749  
 (703) 648-7740  
 (703) 648-7742  
 (703) 648-7743  
 (703) 648-7746  
 (703) 648-7750  
 (703) 648-7751  
 (703) 648-7739

**E-mail**

sanderson@usgs.gov  
 obermude@usgs.gov  
 yfong-sam@usgs.gov  
 agurmend@usgs.gov  
 ckuo@usgs.gov  
 rlevine@usgs.gov  
 tlyday@usgs.gov  
 pmobbs@usgs.gov  
 hnewman@usgs.gov  
 wsteblez@usgs.gov  
 itorres@usgs.gov  
 ptse@usgs.gov  
 jwu@usgs.gov  
 tyager@usgs.gov