



**中国国家标准《石油天然气资源/储量分类》
(GB/T 19492-2004) 与《联合国资源
分类框架》(UNFC) 对接文件**

**Bridging Document
between
National Standard of the People's Republic of China
“Classification for Petroleum Resources/Reserves (GB/T
19492-2004)” and “United Nations Framework
Classification for Resources (UNFC)”**

2018 年 9 月 28 日 日内瓦

Geneva, 28 September 2018

前言 FOREWORD

此对接文件是中华人民共和国自然资源部与联合国欧洲经济委员会友好合作的成果，由国土资源部矿产资源储量评审中心和联合国资源分类专家组的技术顾问组联合起草，自 2015 年 4 月，双方签署编制对接文件协议开始至 2018 年 7 月，历时三年多完成。

This Bridging Document is the result of the friendly cooperation between the Ministry of Natural Resources of People's Republic of China(MNR) and the United Nations Economic Commission for Europe(UNECE). This Bridging Document was developed by the Mineral Resources and Reserves Evaluation Center of the Ministry of Land and Resources in cooperation with the Technical Advisory Group of the Expert Group on Resource Classification. The preparation process lasted more than three years from the beginning when the two sides signed an agreement on the preparation of the Bridging Document in April 2015, until July 2018.

中国国家标准《石油天然气资源/储量分类》(GB/T 19492-2004)与《联合国资源分类框架》(UNFC)对接文件

国土资源部矿产资源储量评审中心与联合国资源分类专家组技术咨询组联合编制¹

综述

本文件为中华人民共和国国家标准《石油天然气资源/储量分类》(GB/T 19492-2004)和《联合国资源分类框架》(UNFC)的对接文件。对接文件的作用是解释 UNFC 与另一个由联合国资源分类专家组认可的“对应分类体系”之间的关系。对接文件包含了如何应用 UNFC 数字编码来对“对应分类体系”评估结果进行分类的说明与指南。本对接文件对比了 GB/T 19492-2004 资源/储量的级别和 UNFC 的类别、级别进行了对比。GB/T 19492-2004 由中国国家质量监督检验检疫总局所属中国国家标准化管理委员会于 2004 年 4 月 30 日发布, 2004 年 10 月 1 日实施。该分类体系为中国的石油、天然气和凝析油资源/储量的评估、评审和披露设立了统一的指南。本对接文件不影响 GB/T 19492-2004 的独立应用, GB/T 19492-2004 的应用也不影响 UNFC 的任何内容。当本对接文件的中文版本与其他语言版本存在任何歧义时, 以中文版本为准。

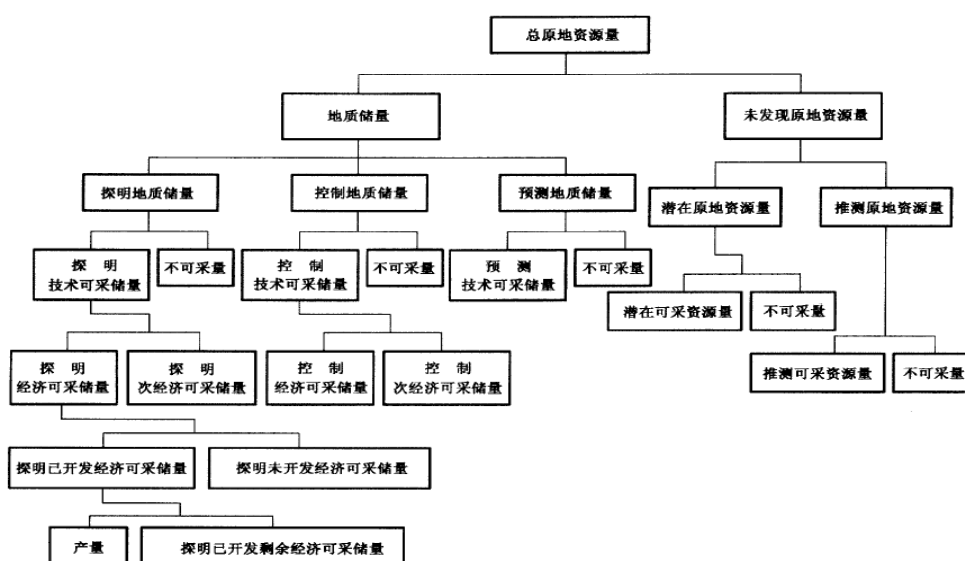
¹ 本对接文件由国土资源部矿产资源储量评审中心与资源分类专家组技术咨询组联合研制。本对接文件经 2017 年 4 月 24 日至 28 日召开的第 8 次专家组大会审查之后, 本对接文件于 2018 年 2 月 15 日至 4 月 15 日进行了公示。本对接文件的研制遵循了专家组第五次会议(2014 年 4 月)上商定的文件批准程序。本对接文件经可持续能源委员会第 27 次会议审定。

I. 前言

1. 对接文件是说明在《联合国资源分类框架》（以下简称“UNFC”）与资源分类专家组（EGRC）认可作为对应体系的另一分类体系之间关系的文件。文件提供了相应的说明和指南，指导用户利用 UNFC 数字编码对对应体系的估算值进行分类。利用 UNFC 数字编码报告估算值时，应明确相关的对接文件。
2. 本文件对中国国家标准《石油天然气资源/储量分类》（GB/T 19492-2004）（以下简称“GB/T 19492-2004”）和 UNFC 有关储量和资源量类别和级别进行了对比。
3. GB/T 19492-2004 是指中华人民共和国国家质量监督检验检疫总局中国国家标准化管理委员会于 2004 年 4 月 30 日发布，于 2004 年 10 月 1 日实施的《石油天然气资源/储量分类》（GB/T 19492 -2004）。该分类为中国的石油、天然气（游离气、气顶气和原油溶解气）和凝析油资源/储量的计算、评审和统计设立了统一的指导原则（图 1）。
4. GB/T 19492-2004 独立于 UNFC，本对接文件不影响 GB/T 19492-2004 的独立应用，GB/T 19492-2004 的应用也不影响 UNFC 的所有组成部分。
5. 在 GB/T 19492-2004 中，油气资源/储量分类主要基于勘探开发程度、地质认识程度和产能证实程度，按水平轴和垂直轴进行分类。

图 1

中国石油天然气资源/储量分类



6. 水平轴按发现与否分为 2 个大类：储量（已发现）和资源量（未发现）。储量进一步划分为预测的、控制的、探明的 3 个级别，它们与资产状况和地质可靠程度相联系。资源量进一步分为潜在的和推测的。垂直轴基于资源的原地属性、技术可采性、经济可采性和开发状态划分为 4 类。

A. 垂直轴：从顶到底包括 4 类

7. 第 1 类：原地量。石油原地量简称为 PIIP（Petroleum Initially In Place）。总原地资源量是指根据不同勘探开发阶段所提供的地质、地球物理与分析化验等资料，经过综合地质研究，选择运用具有针对性的方法所估算求得的已发现的和未发现的储集体中原始储藏的油气总量。

8. 第 2 类：技术可采资源量及储量。技术可采储量简称为 TUR（Technically Ultimate Recovery）。不管其他因素限制或经济标准，它们是技术上从油气藏中可采的数量。不可采量简称为 UQ（Unrecoverable Quantities）。技术可采量和不可采量之和为原地量。远景资源量和推测资源量中的可采资源量简称为 RR（Recoverable Resources）。

9. 第 3 类：经济可采储量。经济可采储量简称为 EUR（Economic Ultimate Recovery），是在指定日期从已知油气藏中经济可采的估算量和累计产量之和。次经济可采储量简称为 SER（Sub-Economic Recovery），是指在经济评价中确定为次经济的技术可采储量，或者由于合同、提高采收率或其他因素影响不能划分为经济可采储量的技术可采储量。经济可采储量和次经济可采储量之和为技术可采储量。只有探明储量和控制储量根据经济可行性评价划分经济状态，即经济的和次经济的可采数量（见第 19 段）。

10. 第 4 类：开发状态。对已批准的开发项目，可划分不同开发状态。为维护整个系统的物质平衡，探明经济可采储量是探明已开发剩余经济可采储量、累计产量和探明未开发经济可采储量之和。只有探明经济可采储量划开发状态（见第 20 段）。

B. 水平轴：从右到左

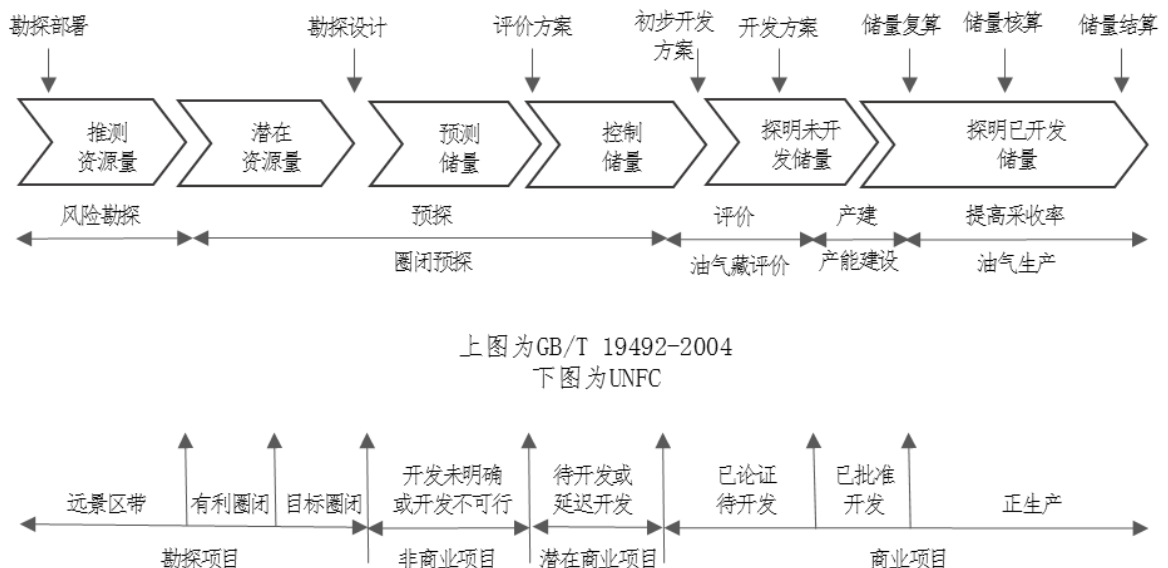
11.在 GB/T 19492-2004 中，与经济可行性评价指标相比，更强调地质认识程度和技术可采性的分类，项目类型与相应的勘探开发阶段有关，因而高度重视地质储量和技术可采储量的分类和分级。

12.GB/T 19492-2004 重视油气藏的整体评价。发现前的原地量确定为未发现原地资源量，发现后的原地量确定为已发现的原地储量（或称为地质储量）。地质储量主要按油气藏整体的地质认识程度和项目状况分级。与资产有关的储量划分为 3 个级别之一，即预测储量、控制储量和探明储量，分别反映油气藏在不同阶段的低、中和高的地质置信度（参见图 2）。

- 发现后：地质置信度低的数量划分为预测储量。没有完成经济评价。
- 在圈闭预探阶段：地质置信度中等的数量划分为控制储量。已完成初步经济评价。
- 在油气藏评价阶段：地质置信度高的数量划分为探明储量，已完成详细经济评价。

图 2

油气储量分类分级和决策过程与勘探开发阶段的对应



C. 原地量

13.未发现原地资源量 (Undiscovered PIIP)：是指对未发现的储集体预测求得的原始储藏油气总量。分为潜在原地资源量和推测原地资源量。

- 潜在原地资源量 (Prospective PIIP)：是指在圈闭预探阶段前期，对已落实的和有利含油气的圈闭或油气藏（田）的邻近区块（层系），根据石油地质条件分析和类比，采用圈闭法估算的原地油气总量。
- 推测原地资源量 (Unmapped PIIP)：是指主要在区域普查阶段或其它勘探阶段，对有含油气远景的盆地、坳陷、凹陷或区带等推测的油气储集体，根据地质、物化探及区域探井等资料所估算的原地油气总量。推测原地资源量一般可用总原地资源量减去地质储量和潜在原地资源量的差值来求得。

14.地质储量 (Discovered PIIP)：是指在钻探发现油气后，根据已发现油气藏（田）的地震、钻井、测井和测试等资料估算求得的已发现油气藏（田）中原始储藏的油气总量。地质储量分为探明地质储量、控制地质储量和预测地质储量（见图 2）。

- 预测地质储量 (Inferred PIIP)：是指在圈闭预探阶段预探井获得了油气流或综合解释有油气层存在时，对有进一步勘探价值的、可能存在的油气藏（田），估算求得的、确定性很低的地质储量。估算预测地质储量具备的条件：（1）应初步查明了构造形态、储层情况；（2）预探井已获得油气流或钻遇了油气层，或紧邻探明储量（或控制储量）区并预测有油气层存在，经综合分析有进一步评价勘探的价值。
- 控制地质储量 (Indicated PIIP)：是指在圈闭预探阶段预探井获得工业油（气）流，并经过初步钻探认为可提供开采后，估算求得的、确定性较大的地质储量，其相对误差不超过 $\pm 50\%$ 。估算控制地质储量应具备的条件：（1）应初步查明了构造形态、储层变化、油气层分布、油气藏类型、流体性质及产能等；（2）具有中等的地质可靠程度；（3）可作为油气藏评价钻探、编制开发规划和开发设计的依据。
- 探明地质储量 (Measured PIIP)：是指在油气藏评价阶段，经评价钻探证实油气藏（田）可提供开采并能获得经济效益后，估算求得的、确定性很大的地质储量，其相对误差不超过 $\pm 20\%$ 。估算探明地质储量应具备的条件：（1）应查明了油气藏类型、储集类型、驱动类型、

流体性质及分布、产能等；（2）流体界面或油气层底界应是钻井、测井、测试或可靠压力资料证实的；（3）应有合理的井控程度，或开发方案设计的一次开发井网；（4）各项参数均具有较高的可靠程度。满足上述条件的可以作为开发投资决策的依据，据此可计算探明经济可采储量。

D. 技术可采性

15.在 GB/T 19492-2004 中，“Measured（探明）”、“Indicated（控制）”和“Inferred（预测）”是表示在不同阶段在同一个油气藏内基于地质置信程度划分的地质储量级别。相应级别地质储量的可采部分分别用“Proved（探明）”、“Probable（控制）”和“Possible（预测）”表示。需要指出，这些术语与 COGEH、PRMS、SEC 等指南中的“Proved（证实）”、“Probable（概算）”和“Possible（可能）”在含义上没有对应关系。

16.可采资源量（Recoverable Resources）：是指从未发现原地资源量中可采出的油气数量。分为潜在可采资源量和推测可采资源量，其采收率是经验类比估算的。

- 潜在可采资源量（Prospective Recoverable Resources）：是指从潜在原地资源量中可采出的油气数量。
- 推测可采资源量（Unmapped Recoverable Resources）：是指从推测原地资源量中可采出的油气数量。

17.技术可采储量（TUR）：是在给定的技术条件下，经理论计算或类比估算的最终可采出的油气数量。

- 预测技术可采储量（Possible TUR）：是指与预测地质储量相联系且满足下列条件所估算的技术可采储量：已经满足预测地质储量的所有要求和成熟度；可能乐观实施的实用技术；将来实际采出量大于或等于估算的技术可采储量的概率至少为 10%。
- 控制技术可采储量（Probable TUR）：是指与控制地质储量相联系且满足下列条件所估算的技术可采储量：已经满足控制地质储量的所有

要求和成熟度；推测可能实施的实用技术；预可行性评价表明开发为次经济以上。

- 探明技术可采储量（Proved TUR）：是指与探明地质储量相联系且满足下列条件所估算的技术可采储量：已经满足探明地质储量的所有要求和成熟度；试验区已经证实的技术（包括采油气技术和提高采收率技术），或在类似油气藏已经成功应用的开采技术；已有开发概念设计或开发方案，并已列入或将列入中近期开发计划；以近期平均价格和成本为准，可行性评价为经济的和次经济的。

18.不可采量（UQ）：是原地量与可采量的差值。在 GB/T 19492-2004 中，不可采量分为 5 个级别，即：推测不可采量、潜在不可采量、预测不可采量、控制不可采量和探明不可采量。

E. 经济可采储量

19.经济可采储量（EUR）：是指当前已实施的或肯定要实施的技术条件下，按现行的经济条件（如价格、成本等）或相关协议约定的经济条件估算的、可经济开采的油气数量；分为控制经济可采储量、控制次经济可采储量、探明经济可采储量和探明次经济可采储量。

- 控制经济可采储量（Probable EUR）：是指与控制地质储量相联系且满足下列条件所估算的经济可采储量：（1）已经满足控制地质储量的所有要求和成熟度；（2）预可行性评价表明开发为经济的；（3）将来实际采出量大于或等于估算的经济可采储量的概率至少为 50%。
- 控制次经济可采储量（Probable SER）：是指控制技术可采储量与控制经济可采储量的差值。
- 探明经济可采储量（Proved EUR）：是指与探明地质储量相联系且满足下列条件所估算的经济可采储量：（1）已经满足探明地质储量的所有要求和成熟度；（2）已实施的应用技术，或先导试验证实的并肯定付诸实施的应用技术，或本油气田同类油气藏实际应用成功的并可类比和肯定付诸实施的应用技术；（3）已有开发方案，输油气设施可用或将使用，并已列入中近期开发计划；（4）天然气储量还

应已铺设天然气管道或已有管道建设协议,并有销售合同或协议;(5) 含油气边界是钻井或可靠的压力测试资料证实的流体界面,或者是钻遇井的油气层底界,并且含油气边界内达到了合理的井控程度;(6) 实际生产或测试证实了油气层的商业性生产能力,或目标储层与邻井同层位或本井邻层位已证实商业性生产能力的储层相似;(7) 依据不同要求采用在合同或协议中规定的价格和成本以及其它有关的经济条件,可行性评价表明开发是经济的;(8) 将来实际采出量大于或等于估算的经济可采储量的概率至少为 80%。

- 探明次经济可采储量 (Proved SER): 是指探明技术可采储量与探明经济可采储量的差值,包括如下两部分:(1) 可行性评价表明开发为次经济的技术可采储量;(2) 由于合同和提高采收率技术等原因,尚不能划为探明经济可采储量的技术可采储量。

F. 开发状态

20.探明经济可采储量按开发和生产状态进一步分为:探明已开发经济可采储量、探明未开发经济可采储量。探明已开发剩余经济可采储量 (Proved Developed Reserves) 是指扣除了累计产量后的探明已开发经济可采储量。

- 探明已开发经济可采储量 (Proved Developed EUR): 是指根据油气藏已批准的开发方案,在钻完井和相关设施完成后,已投入开发的可采储量。当提高采收率技术(如注水等)所需的设施已经建成并已投产后,相应增加的可采储量也属于探明已开发经济可采储量。探明已开发经济可采储量应在开发生产过程中定期进行更新。
- 探明未开发经济可采储量 (Proved Undeveloped EUR): 是指已完成评价钻探或已经开辟先导生产试验区的油气藏(田),尚未钻开发生产井网的经济可采储量。

21.GB/T 19492-2004 评价可采储量时,首先计算技术可采储量,然后对探明或控制技术可采储量进行经济评价,划分经济和次经济可采储量,预测技术可采储量不进行经济评价。当经济评价后会出现两种状况:

- 若油气藏开发项目是经济的，这时次经济可采储量等于技术可采储量减去经济可采储量；
- 若油气藏开发项目是次经济的，这时次经济可采储量等于技术可采储量。

II. 级别和亚级的直接对应

A. G 轴的应用（地质认识和潜在可采量的置信度）

22.UNFC 中，在已知或已发现矿床内的原地不可采量和可采量按置信度分为高、中、低三级，分别用 G1、G2、G3 表示。待发现的矿床（勘探阶段项目）赋予 G4 类置信度。

23.GB/T 19492-2004 分类中，地质储量是以油气藏为基本的计算单元，主要采用确定性的容积法计算。根据油气藏整体勘探开发程度和地质认识程度综合确定油气藏的储量级别，即每个油气藏有一个独立的级别，对同一个油气藏,按不同勘探开发阶段的勘探开发程度和地质认识程度由低到高依次分为预测、控制和探明储量（图 2）。GB/T 19492-2004 分类中，技术可采储量和经济可采储量与地质储量级别具有对应关系。探明储量级别包括探明地质储量、探明技术可采储量、探明经济可采储量、探明次经济可采储量、探明不可采量等类别，都具有高置信度（G1）；控制储量级别包括控制地质储量、控制技术可采储量、控制经济可采储量、控制次经济可采储量、控制不可采量等类别，都具有中置信度（G1+G2）；预测储量级别包括预测地质储量、预测技术可采储量和预测不可采量，都具有低置信度（G1+G2+G3）。UNFC 没有对原地不可采量和技术可采量分级。为保持 GB/T 19492-2004 的完整性，原地量和可采量的分级如表 1 所示。

24.对于勘探项目，UNFC 根据地质不确定性提供了可选择的 G4.1、G4.2、G4.3 亚级。而在 GB/T 19492-2004 分类中，这些级别定义为 G4，不再细分亚级，单独使用时，它反映最佳估算量。

表 1

GB/T 19492-2004 与 UNFC 地质认识和潜在可采量置信度对比表

GB/T 19492-2004 类别与级别							UNFC 级别
已发现	探明	地质储量	技术可采储量	经济可采储量	探明已开发	产量	采出量
					探明未开发	剩余经济可采储量	G1
				次经济可采储量			
				不可采量			
			控制	地质储量	技术可采储量	经济可采储量	
	次经济可采储量						
	不可采量						
	预测	地质储量	技术可采储量		G1+G2+G3		
			不可采量				
	未发现	潜在	原地资源量	可采资源量		G4	
不可采量							
推测		原地资源量	可采资源量				
			不可采量				

B. E 轴和 F 轴的详细对应

25.G 轴（地质认识和潜在可采量的置信度）表示油藏内的不确定性和置信度，用于对比的 E 轴（社会经济可行性）和 F 轴（油气项目状况和可行性）建立的详细矩阵如图 3 所示。

图 3

E-F 矩阵与 GB/T 19492-2004 级别和类别的对应关系

	F1.1	F1.2	F1.3	F2.1	F2.2	F2.3	F3.1	F3.2	F3.3	F4
E1.1	1	2	3	4						
E1.2	1	2	3							
E2	4	4	4	4	5					
E3.1	12	12	12	12	12	12				
E3.2			6	6	6		8	9	10	
E3.3			7	7	7	7				11

类	亚类	代码	GB/T 19492-2004 类别/级别
商业项目	正生产	1	探明已开发剩余经济可采储量
	已批准开发	2	探明未开发经济可采储量
	已论证可开发	3	探明未开发经济可采储量
潜在商业项目	待论证开发	4	探明次经济可采储量、控制经济可采储量、控制次经济可采储量、预测技术可采储量
	延迟开发	5	探明次经济可采储量、控制经济可采储量、控制次经济可采储量、预测技术可采储量
非商业项目	开发未明确	6	探明次经济可采储量、控制次经济可采储量、预测技术可采储量
	开发不可行	7	探明次经济可采储量、控制次经济可采储量、预测技术可采储量
原地不可采量		11	探明、控制和预测不可采量
勘探项目	目标圈闭	8	潜在可采资源量
	有利圈闭	9	
	远景区带	10	推测可采资源量
原地不可采量		11	潜在和推测不可采量
预计采出但不销售的量		12	

26.没有亚类对应的简化版如表 2 所示。需要说明的是，UNFC 的 E 和 F 分级设置了“最低限度”标准。例如，一个潜在商业项目必须至少是 E2 和 F2，但也可以是 E2F1。

C. 勘探项目

27.E-F 矩阵中有 4 个网格（8、9、10、11）与 GB/T 19492-2004 中不同成熟度勘探项目的未发现资源量类别相对应。UNFC 使用 G4 级别进行勘探项目的分级。UNFC 允许 G4 进一步分级，以反映可采量的不确定性（G4.1，G4.2，G4.3），而 GB/T 19492-2004 不分级，G4 单独使用时反映最佳估算量。

D. 原地不可采量

28.UNFC 原地不可采量对应 GB/T 19492-2004 任何类别目前评估为技术不可采的油气数量。在 UNFC 中，原地不可采量划分为 E3.3F4 类。

表 2

GB/T 19492-2004 与 UNFC 分类分级的对应

GB/T 19492-2004 类别/级别		UNFC “最低限度” 级别			UNFC 类别
已发现	探明已开发剩余经济可采储量、探明未开发经济可采储量	G1	E1	F1	商业项目
	探明次经济可采储量	G1	E2	F2	潜在商业项目
	控制经济可采储量、控制次经济可采储量	G1+G2			
	预测技术可采储量	G1+G2+G3			
	探明次经济可采储量	G1	E3	F2	非商业项目
	控制次经济可采储量	G1+G2			
	预测技术可采储量	G1+G2+G3			
	不可采量（探明）	G1	E3	F4	原地不可采量
	不可采量（控制）	G1+G2			
	不可采量（预测）	G1+G2+G3			
未发现	潜在可采资源量、推测可采资源量	G4	E3	F3	勘探项目
	不可采量（潜在、推测）	G4	E3	F4	原地不可采量

III. GB/T 19492-2004 类别对应多个 UNFC 亚级

29.UNFC 的级别要多于 GB/T 19492-2004。因此，多数情况下，GB/T 19492-2004 单个级别可能反映 UNFC 亚级的多种组合。这反映在图 3 中。

30.UNFC 基于三轴（E，F，G），允许对应各类项目的成熟度水平来界定类别和亚类。尽管 GB/T 19492-2004 没有明确按项目的成熟度水平来界定亚类，但级别（及其相应的类别）的划分是基于与 UNFC 同样的原则，即地质不确定性程度（G 轴）和项目状态（E 轴和 F 轴）密切联系，且可以表达成如图 1 的水平轴。图 1 的垂直轴包括经济评价，且与 E 轴对应。因此，可以将 GB/T 19492-2004 级别及其类别与 UNFC 类和亚类建立关系（图 3）。

31.UNFC 用四种类别描述“已知油气聚集”：“商业项目”、“潜在商业项目”、“非商业项目”和“原地不可采量”。图 3 未包括开采销售产量，而非销售产量用代码 12 表示。

A. 商业项目的亚级细分

32.在 GB/T 19492-2004 中，探明已开发剩余经济可采储量和探明未开发经济可采储量对应 UNFC “商业项目”类别。这两类可采储量所对应的开发项目的开发方案已得到批准或者开发方案已通过论证，证明商业开发是可行的，可细分为 UNFC 的 E1.1 亚级。

33.探明已开发剩余经济可采储量直接对应于 UNFC 的“正生产”项目亚类（F1.1）。开发方案已批准的探明未开发经济可采储量对应于 UNFC 的“已批准开发”项目亚类（F1.2）。已批准开发项目是指开发资金已落实，开发项目正在实施中。

34.已进行开发可行性研究但开发方案尚未获批的探明未开发经济可采储量对应“已论证可开发”项目亚类（F1.3）。已论证可开发项目是指已进行足够详细的研究，通过开发项目的落实，表明了开发的可行性。项目的技术可采性得到确认，且对项目所涉及的开发方案、协议或合同即将获得政府或有关当事方的批准有合理的预期。

35.若按目前市场条件进行未来预测评价，开采和销售量没有经济效益，但若按享有政府补贴或其他条件，评价为经济可行，在 UNFC 中界定为 E1.2 亚级。同样在 GB/T 19492-2004 中，探明已开发剩余经济可采储量和探明未开发经济可采储量可对应 E1.2 亚级。

36.从探明已开发剩余经济可采储量、探明未开发经济可采储量、探明次经济可采储量、控制经济可采储量、控制次经济可采储量和预测技术可采储量中，预计开采出的但非销售的数量对应 UNFC 的 E3.1 亚级。可采非销售量 E3.1 亚级与可采销售量所对应的项目亚级（F 轴）一致，项目的不确定性也反映地质不确定性的程度。

B. 潜在商业项目和非商业项目的亚级细分

37.在 GB/T 19492-2004 中，探明次经济可采储量、控制经济可采储量、控制次经济可采储量和预测技术可采储量对应 UNFC “潜在商业项目”类。因为这四类可采储量通过油价上升或改变其他经济参数、技术进步或其他条件的改善，有合理预期成为商业可采，由此可细分为 UNFC 的 E1 和 E2 亚级。主要包括以下三类项目：

- 在油气藏评价阶段结束，经过开发可行性评价，含有与探明经济可采储量相伴生的探明次经济可采储量项目；
- 在圈闭预探阶段后期，经过开发预可行性评价，含有边际经济以上的控制经济可采储量和控制次经济可采储量项目；
- 在油气发现后，具有升级潜力且评价升级活动在进行的预测技术可采储量的项目。

38.在圈闭预探阶段，GB/T 19492-2004 中的预测技术可采储量和控制次经济可采储量，可划分为 UNFC “非商业项目”类。它们被定义为 UNFC 的 E3 级。某些时候，基于新信息，可更新经济条件。UNFC 包括如下级别：在可预见未来可能会有合理的经济开采和销售前景（E2）；因为信息不充分而无法确定经济可行性（E3.2）；基于合理假设的未来市场条件，目前认为在可预见未来没有合理的经济开采和销售前景（E3.3）。

39.关于项目成熟度的界定：正在开展项目活动据此论证在可预见未来开发具有合理性（F2.1）、项目活动暂停（F2.2）、因为潜力有限，当前没有开发或获取新增数据的计划（F2.3）。

40. 与 UNFC 中级别和亚级的对应，应基于如下原则：

- 待论证开发项目最低限度必须满足 F2.1 和 E2 的定义。满足所有技术要求但没有达到当前经济门槛的项目（尚无审批通过的开发方案）界定为 F1.3。技术可行性问题有待解决的项目界定为 F2.1，但如果其商业活力毋庸置疑，则可满足 E1.1 亚级的定义。
- 延迟开发项目类似于待论证开发项目，但商业性的进展受限于评价者或评价者以外的外部因素。延迟开发项目界定为 E2F2.2，反映存在商业性机会，但目前项目活动暂停。

- 开发未明确项目是指目前没有足够依据，无法认定具有最终经济可采合理前景的项目。一般是由于缺乏评价所需的数据或者评价仍处于初期阶段所造成。这种项目根据商业可行性细分为 E3.2 亚级，根据技术成熟度分为 F1.3、F2.1 或 F2.2。
- 开发不可行项目是指具有潜在技术可行性的项目（根据现有技术以及正在研发的技术），但评估认为这些项目不具备足够的潜力，不能说明有必要进一步采集数据或为消除当前的商业条件制约做任何直接努力，但可以作为某种组合的一部分确认并记录这些数量，以便在商业条件发生重大变化时，可能重新评价商业开发的潜力。在可预见的未来，这些项目不具有商业开发的潜力，在 UNFC 中界定为 E3.3 亚级。典型的情况是，因项目潜力有限而难以进入成熟期，所以这些项目界定为 F2.3 亚级。也存在这样的情况，例如，项目成熟度达到 F1.3 亚级，但商业条件发生大幅度变化导致项目开发不可行。

41.GB/T 19492-2004 中油气藏评价活动正在进行，但经济性明确的控制经济可采储量和预测技术可采储量对应于 E1.1F2.1，与控制经济可采储量相伴生的控制次经济可采储量对应 E2F2.1 或 E3F2.1。由于不可控因素如油气价格下降等原因造成目前项目不经济，对于油气藏已投产项目，所估算的探明已开发次经济可采储量对应 E2F1.1；或者，对于已批准开发方案或开发方案正在实施的项目，所估算的探明未开发次经济可采储量对应 E2F1.2。对尚未批准开发方案的项目所估算的探明未开发次经济可采储量对应 E2F1.3。

42.如果在可预见未来对最终经济开采和销售有合理前景（E2），但是项目实施暂停，那么油气藏评价阶段所估算的探明次经济可采储量以及圈闭预探阶段所估算的控制经济可采储量、控制次经济可采储量和预测技术可采储量对应于 UNFC 中 E2F2.2 “延迟开发”项目亚类。

43.在 GB/T 19492-2004 中，对低于边际经济门槛的探明次经济可采储量和控制次经济可采储量及经济意义待定的预测技术可采储量，对应于 UNFC “非商业项目”类。如果因为信息不充分而无法确定其开采的经济可行性（E3.2 亚级），那么这些储量类别应对应于“开发未明确”项目亚类。其项目可行性轴对应于 UNFC 的 F1.3、F2.1、F2.2 亚级，探明次经济可采储

量属于评价活动已结束，技术上可行，对应 F1.3 亚级；具有评价升级和录取新数据计划的控制次经济可采储量和预测技术可采储量对应 F2.1 亚级；如果评价活动延迟，这种控制次经济可采储量和预测技术可采储量对应 F2.2 亚级。如果基于合理假设的未来市场条件认为，探明次经济可采储量、控制次经济可采储量以及预测技术可采储量在可预见的未来经济开采没有合理前景（E3.3 亚级），那么这些储量类别对应于“开发不可行”项目亚类。

44.在 E-F 矩阵里 E3.1 表示预计可采的非销售量，用数字符号 12 表示，在 GB/T 19492-2004 中没有定义，已包括在经济可采储量类别中。这点与 UNFC 不同（详见第 50 段）。

IV. GB/T 19492-2004 勘探开发阶段划分与 UNFC 类别划分对应的说明

45.需要说明的是，GB/T 19492-2004 不是直接按项目成熟度进行分类，而是根据勘探开发阶段。在很大程度上，GB/T 19492-2004 的阶段划分与 UNFC 的类别划分之间有一定可比性，对应关系如图 4 所述。

图 4

GB/T 19492-2004 勘探开发阶段与 UNFC 项目划分的对应关系

GB/T 19492-2004			UNFC	
油气储量/资源量类别及阶段/项目划分			类别	亚类
已发现	探明储量 (已开发)	油气生产阶段 /提高采收率项目	商业项目	正生产
	探明储量 (未开发)	产能建设阶段 /产能建设项目		已批准开发
		油气藏评价阶段 /评价项目		已论证可开发
	控制储量	圈闭预探阶段 /预探项目	潜在商业 项目	待开发或延迟开发
	预测储量		非商业 项目	开发未明确或开发 不可行
未发现	潜在资源量	区域普查阶段 /风险勘探项目	勘探项目	目标圈闭
	推测资源量			有利圈闭
				远景区带

46.需要注意的是，在油气藏评价阶段，油气藏认识已经清楚，开发方案已明确。然而，开发方案设计的某些细节尚没有最后确定，开发方案尚待批准。

47.正如 UNFC 项目成熟度类别决定可采量的商业性一样，GB/T 19492-2004 勘探开发阶段划分决定了资源储量的级别。随着项目勘探开发程度逐步提高，其商业成熟度也逐步增加，资源储量的置信度和商业性得到提高。实际上，GB/T 19492-2004 中区域普查阶段相当于风险勘探项目，圈闭预探阶段相当于预探项目，油气藏评价阶段相当于评价项目，产能建设阶段相当于产能建设项目，油气生产阶段主要相当于提高采收率项目，与 UNFC 的类和亚类有一定对应关系。

48.评价项目、产能建设项目和提高采收率项目对应 UNFC 的“商业项目”。其中，提高采收率项目包括加密井、注水（汽）、注气和注聚合物等，与 UNFC 分类的“正生产”亚类对应。产能建设项目对应开发方案已批准或/和正在建产的探明未开发储量，与 UNFC 分类的“已批准开发”亚类对应。油气藏评价项目结束的成果是探明未开发储量，对应已完成开发方案的编制，与 UNFC 分类的“已论证可开发”亚类对应。

49.预探项目对应 UNFC “潜在商业项目”、“非商业项目”和“勘探项目”。圈闭预探项目获得已发现的控制储量、预测储量和未发现的潜在资源量。控制储量主要与 UNFC “潜在商业项目”的“待开发”或“延迟开发”亚类对应。预测储量主要与 UNFC “非商业项目”的“开发未明确”或“开发不可行”亚类对应。潜在资源量与 UNFC “勘探项目”的“目标圈闭”和“有利圈闭”亚类对应。

50.风险勘探项目与 UNFC “勘探项目”的“远景区带”亚类对应，以获得未发现的推测资源量。

V. GB/T 19492-2004 未界定和无分类数量的说明

51.如上文所述，UNFC 规定，所有非销售量（燃料气、火炬气和损耗）可在销售量之外分别列出和记录。在 UNFC 内，当需要区分燃料气、火炬气和损耗时，每种非销售量应当作为一个不同的产品种类（见 UNFC 通则 D）进行核算并独立报告。GB/T 19492-2004 中未对非销售量进行界定和归类。

Bridging Document between the National Standard of the People's Republic of China Classification for Petroleum Resources/Reserves (GB/T 19492-2004) and the United Nations Framework Classification for Resources

Prepared by the Mineral Resources and Reserves Evaluation Center of Ministry of Land and Resources in cooperation with the Technical Advisory Group of the Expert Group on Resource Classification¹

Summary

This document provides the Bridging Document between the National Standard of the People's Republic of China Classification for Petroleum Resources/Reserves (GB/T 19492-2004) and the United Nations Framework Classification for Resources (UNFC). Bridging documents explain the relationship between UNFC and another classification system that has been endorsed by the Expert Group on Resource Classification as an Aligned System. They incorporate instructions and guidelines on how to classify estimates generated by application of that Aligned System using the UNFC Numerical Codes. This Bridging Document compares reserves and resources by Categories of GB/T 19492-2004 to Categories and Classes of UNFC. GB/T 19492-2004 was issued by the Standardization Administration of the People's Republic of China under the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China on 30 April 2004, and implemented on 1 October 2004. It establishes unified guidance regarding China's principles for evaluation, auditing and reporting of reserves and resources of crude oil, natural gas and gas condensate. This Bridging Document does not affect the independent application of GB/T 19492-2004 and application of GB/T 19492-2004 does not affect any component of UNFC. In the event of any difference between the Chinese language version and any other language version, the Chinese language version shall prevail.

¹ This Bridging Document was developed by the Mineral Resources and Reserves Evaluation Center of Ministry of Land and Resources in cooperation with the Technical Advisory Group of the Expert Group on Resource Classification. Following review by the Expert Group at its eighth session, 24–28 April 2017, the Bridging Document was issued for public comment from 15 February to 15 April 2018. Development of this Bridging Document has followed the Document Approval Procedure agreed by the Expert Group at its fifth session, April 2014. The Bridging Document is presented to the Committee on Sustainable Energy at its twenty-seventh session for endorsement.

I. Introduction

1. Bridging Documents explain the relationship between the United Nations Framework Classification for Resources (hereinafter referred to as “UNFC”) and another classification system that has been endorsed by the Expert Group on Resource Classification as an Aligned System. They incorporate instructions and guidelines on how to classify estimates generated by application of that Aligned System using the UNFC Numerical Codes. The relevant Bridging Document shall be identified when reporting estimates using the UNFC Numerical Codes.

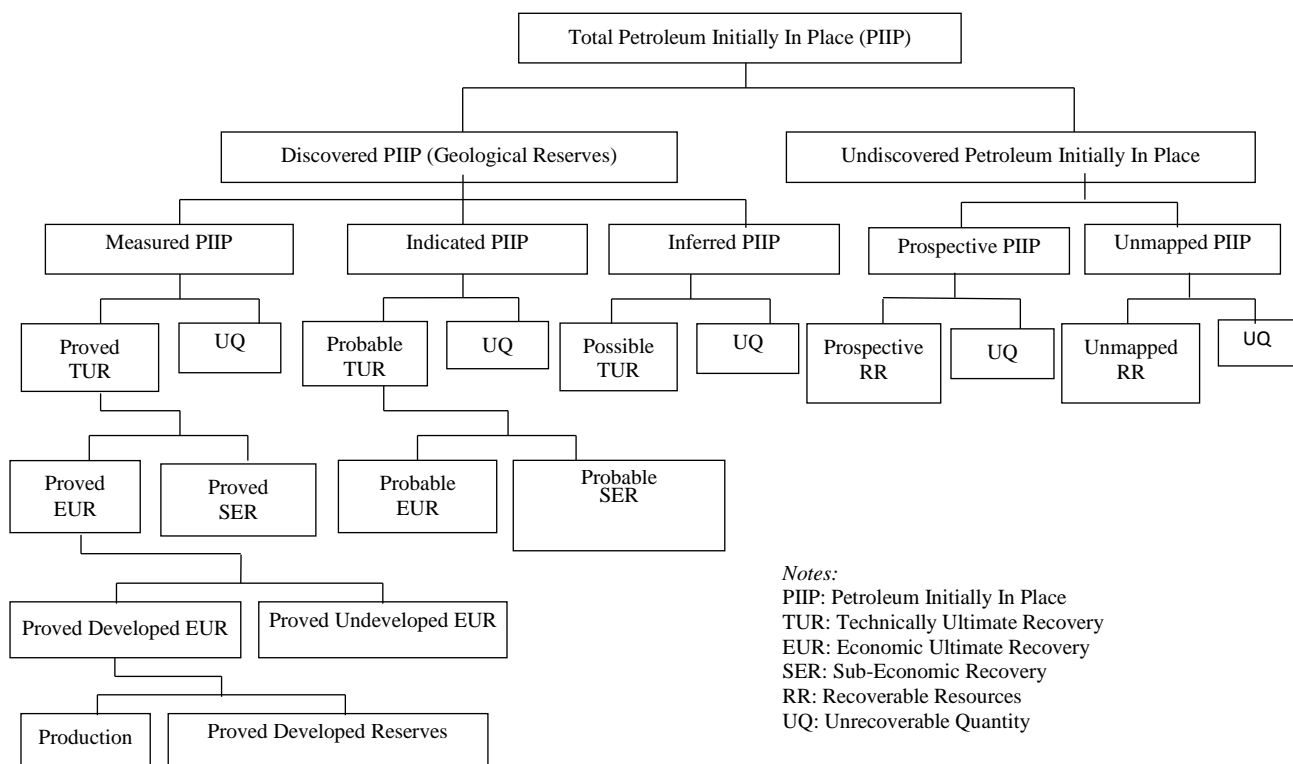
2. This document compares reserves and resources by categories of the National Standard of the People's Republic of China “Classification for Petroleum Resources/Reserves” (GB/T 19492-2004) hereinafter referred to as “GB/T 19492-2004”) with Categories and Classes of UNFC.

3. GB/T 19492-2004 was issued by the Standardization Administration of the People's Republic of China under the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China on 30 April 2004, and implemented on 1 October 2004. It establishes unified guidance regarding China's principles for evaluation, auditing and reporting of reserves and resources of crude oil, natural gas and gas condensate (Figure 1).

4- GB/T 19492-2004, the enforced guidelines for the reporting of oil and gas reserves to the Chinese Government, is independent of UNFC. This Bridging Document does not affect the independent application of GB/T 19492-2004. The application of GB/T 19492-2004 does not affect any component of UNFC.

Figure 1

Chinese Classification for Petroleum Resources/Reserves



5. In GB/T 19492-2004, the classification is mainly based on exploration and development phases, geological knowledge and confirmation of productivity. The classification of volumes according to GB/T 19492-2004 is divided into different classes and categories according to the vertical and horizontal axes.

6. The horizontal axis is divided into two major classes according to the status of discovery: Reserves (discovered) and Resources (undiscovered). According to the status of the asset and the geological reliability, the Geological Reserves are sub-divided further into three categories: Inferred, Indicated and Measured; Resources is sub-divided further into two categories: Prospective and Unmapped. The vertical axis is divided into four classes, based on the resources attributes: PIIP (Petroleum Initially In Place), TUR (Technically Ultimate Recovery), EUR (Economic Ultimate Recovery) and Development Status.

A. The Vertical Axis: covers four classes from top to bottom

7. First class: Volumes in place. PIIP is an abbreviation of Petroleum Initially In Place. Total Petroleum Initially In Place (PIIP) refers to the total oil and gas quantities existing initially in discovered and undiscovered accumulations which are estimated by using appropriate methods, based on the geological, geophysical and laboratory data available in different exploration and development phases.

8. Second class: Technical recoverability. TUR is an abbreviation for Technically Ultimate Recovery. These are the volumes that can technically be recovered from the reservoir, regardless of other constraints or economic criteria. Unrecoverable Quantities are abbreviated to UQ. The summation of TUR and UQ will provide the PIIP. For prospective and unmapped resources, RR replaces TUR, and it is an abbreviation for Recoverable Resources.

9. Third class: Economic viability. EUR is an abbreviation of Economic Ultimate Recovery and refers to those quantities of petroleum which are estimated, on a given date, to be economically recoverable from an accumulation, plus the quantities already produced. SER, an abbreviation of Sub-Economic Recovery, refers to the technically ultimate recovery that is determined to be sub-economic in economic evaluation, or cannot be classified as EUR with consideration to contract, enhanced recovery technology or other factors. The sum of EUR and SER will provide the TUR. Economic viability is only considered in the case when the volumes are categorized as Indicated or Measured (see paragraph 19).

10. Fourth class: Development status. For an approved project, this level provides the detailed development status of all volumes. The sum of Cumulative production, Proved Developed Reserves and Proved Undeveloped EUR is equal to the Proved EUR, maintaining the balance in the whole system. Development status is only estimated for the volumes categorized as Proved EUR (see paragraph 20).

B. The Horizontal Axis: from right to left

11. In GB/T 19492-2004, the classification focuses more on geological knowledge and technical recoverability than on economic viability. As the type of project is related to the exploration and development phases, the classification and categorization of Geological Reserves (also known as Discovered PIIP) and TUR are considered important.

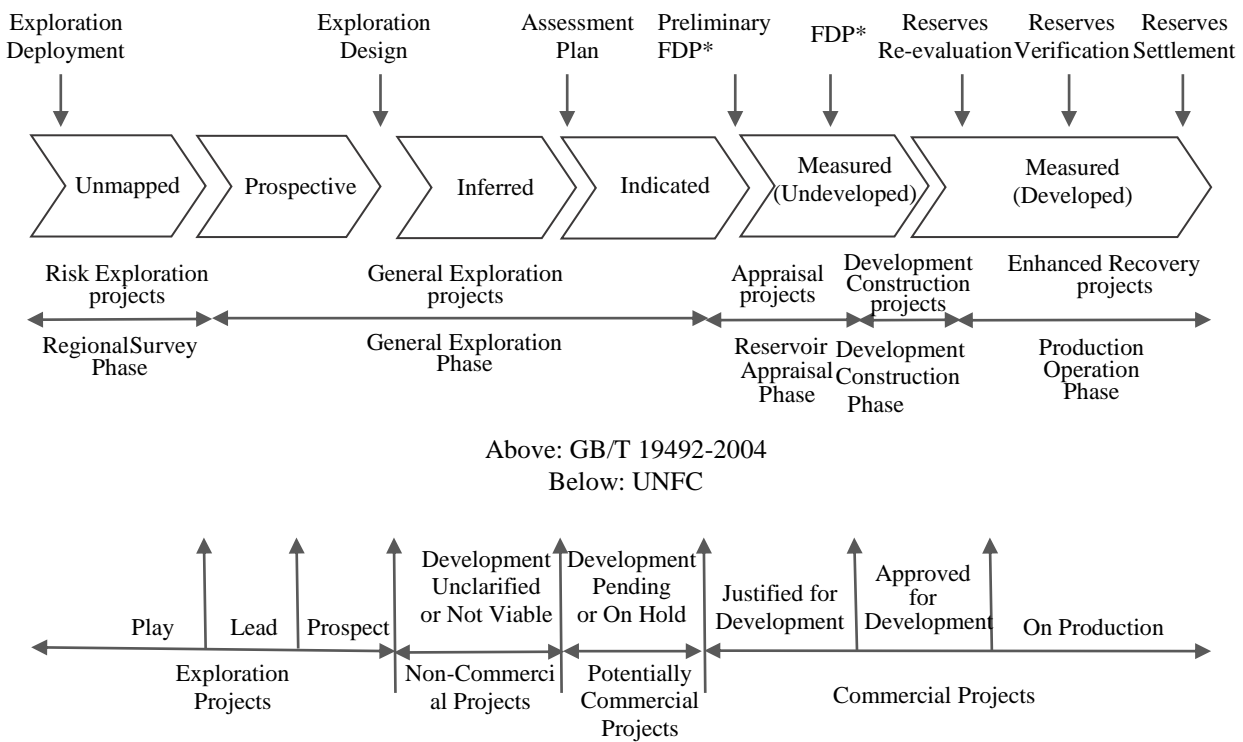
12. GB/T 19492-2004 emphasizes the overall assessment status of petroleum reservoirs. Before the discovery, the volumes are classified under the Undiscovered PIIP class. After discovery, they will be classified under Discovered PIIP (or Geological Reserves). The

Discovered volumes are also classified based on the project status and the level of geological knowledge associated with the petroleum reservoir. The Geological Reserves associated with the asset are assigned to one of three categories: Inferred, Indicated or Measured. These categories reflect the degree of geological confidence from low, moderate and high for the same reservoir in different stages of exploration and development, respectively (see Figure 2):

- After discovery: low geological confidence. Volumes are categorized as "Inferred". No economic evaluation is completed yet.
- During the General Exploration phase: moderate geological confidence. Volumes are categorized as "Indicated". Preliminary economic evaluations are completed.
- After the Reservoir Appraisal phase: high geological confidence. Volumes are categorized as "Measured". Detailed economic evaluations are completed.

Figure 2

Classification and Categorization correspond to the Exploration and Development phases and the decision-making process



Note: * FDP – Field Development Plan

C. In Place Volumes

13. Undiscovered PIIP: refers to the total quantities of oil and gas estimated in unknown accumulations based on predictions. It can be categorized as Prospective PIIP and Unmapped PIIP.

- Prospective PIIP: refers to the Total Petroleum Initially In Place in known and confirmed favourable traps or blocks (formations) adjacent to oil and/or gas reservoirs estimated by the trap method at the early stage of the General

Exploration phase, through analysis and analogy of petroleum geological conditions.

- Unmapped PIIP: refers to the Petroleum Initially In Place in the prospecting basin, depression, sag, belt and other accumulations, which is estimated in the Regional Survey phase or other exploration phases, based on geological, geophysical and geochemical surveys, and regional exploratory well data. It is generally the Total Petroleum Initially In Place minus the Prospective PIIP and minus the Geological Reserves.

14. Geological Reserves (Discovered PIIP): refers to the total oil and gas quantities estimated based on seismic, drilling, well logging and test data in known reservoirs/fields after oil and gas are found by drilling. It can be categorized as Inferred PIIP, Indicated PIIP and Measured PIIP based on project status and geological knowledge (see Figure 2).

- Inferred PIIP: refers to the Geological Reserves that are estimated during the General Exploration Phase with a low level of confidence when oil and/or gas flows are obtained from a wildcat well, or the integrated interpretation indicates the probable existence of oil and/or gas layers. Further exploration will be required. The Inferred PIIP is estimated under the preconditions that: (1) the structural configurations and reservoir conditions should be preliminarily ascertained; and (2) a wildcat has obtained oil and/or gas flows or encountered oil and/or gas layers, or the reservoir/field is immediately adjacent to Measured (or Indicated) oil and/or gas zones, which show further exploration potential through comprehensive analysis.
- Indicated PIIP: refers to the Geological Reserves that are estimated with a moderate level of confidence and relative error not more than $\pm 50\%$ after commercial oil or gas flows are obtained from a prospecting well during the General Exploration Phase. The volumes will be categorized as Indicated PIIP under the conditions that: (1) Preliminary studies have provided information about the structural configuration, reservoir formation continuity, oil and gas distribution, reservoir type, fluid properties and productivities, etc.; (2) the level of geological confidence is moderate; and (3) it can be used as evidence for drilling reservoir appraisal wells and making conceptual design or development plans.
- Measured PIIP: refers to the Geological Reserves that have been proved economically recoverable by appraisal drilling during the Reservoir Appraisal phase. The volumes are estimated with a high level of confidence and relative error, not more than $\pm 20\%$. The volumes will be categorized as Measured PIIP if: (1) the reservoir type, depositional environment, drive mechanism, fluid properties and distributions, and productivities etc. are known; (2) fluid contacts or the lowest known hydrocarbons are determined by drilling, logging and testing data or reliable pressure data; (3) reasonable well control or primary development well pattern designed in a development plan is available; and (4) all parameters have a high level of certainty. If the conditions above are met, a Final Investment Decision is expected for the development of the asset and proved EUR can be estimated.

D. Technical Recoverability

15. In the GB/T 19492-2004, “Measured” “Indicated” and “Inferred” are categories of PIIP within a reservoir based on geological confidence in a different phase. “Proved”, “Probable” and “Possible” refer to the recoverable portions of Measured, Indicated and Inferred respectively. It should be noted that this terminology is NOT linked to the

meanings given for “Proved”, “Probable” and Possible” contained in guidelines such as the Canadian Oil and Gas Evaluation Handbook (COGEH), the Petroleum Resources Management System (PRMS), and those provided by the United States Securities and Exchange Commission (SEC).

16. Recoverable Resources (RR): refers to the recoverable oil and gas quantities from the Undiscovered PIIP. It can be categorized as Prospective RR and Unmapped RR, for which the recovery factors are estimated by the empirical analogy method.

- Prospective RR: refers to the recoverable oil and gas quantities from the Prospective PIIP.
- Unmapped RR: refers to the recoverable oil and gas quantities from the Unmapped PIIP.

17. Technically Ultimate Recoveries (TUR) are those volumes of petroleum which are estimated theoretically or by the use of analogues to be recoverable from discovered accumulations under given technological condition.

- Possible TUR: refers to the Technically Ultimate Recovery associated with Inferred PIIP, and meeting the following requirements: (1) All requirements and maturity for the Inferred PIIP have been met; (2) The applicable technology is likely to be implemented; (3) There should be at least 10% probability that the quantities actually to be recovered in the future will equal or exceed the estimated TUR.
- Probable TUR: refers to the Technically Ultimate Recovery associated with Indicated PIIP, meeting the following requirements: (1) All requirements and maturity for the Indicated PIIP have been met; (2) The applicable technology is presumed to be probably implemented; (3) The feasibility studies show the development is above sub-economic.
- Proved TUR: refers to the Technically Ultimate Recovery associated with Measured PIIP, meeting the following requirements: (1) All requirements and maturity for the Measured PIIP have been met; (2) The technology (including oil and/or gas production technology and enhanced recovery technology) has been demonstrated by pilot projects, or the recovery technology has been used successfully in analogous reservoirs; (3) The conceptual design or development plan is available, and the development has been implemented or will be implemented in the near future; (4) The feasibility study has been carried out based on recent average prices and costs.

18. Unrecoverable Quantities (UQ): refers to the difference between the PIIP and the Recoverable Quantity (RQ). In GB/T 19492-2004, the UQ can be divided into five categories, corresponding to the Unmapped, Prospective, Inferred, Indicated and Measured categories respectively.

E. Economic Ultimate Recoveries (EUR)

19. Economic Ultimate Recoveries (EUR): are those quantities of petroleum which are anticipated to be economically recoverable from discovered accumulations under existing economic conditions (such as prices, costs, etc.) or economic conditions defined by relevant contract, and under current executed or planned to be established technical operating conditions. They are divided into four categories: Probable EUR, Probable SER, Proved EUR and Proved SER.

- Probable EUR: refers to the economic ultimate recovery, associated with Indicated PIIP, meeting the following requirements: (1) All requirements and maturity for

the Indicated PIIP have been met; (2) The preliminary feasibility studies show the development is economic; (3) There should be at least 50% probability that the quantities recovered in the future will equal or exceed the estimated EUR.

- Probable SER: refers to the difference between the Probable TUR and the Probable EUR.
- Proved EUR: refers to the economic ultimate recovery, associated with Measured PIIP, meeting the following requirements: (1) All requirements and maturity for the Measured PIIP have been met; (2) The applicable technology has been implemented, or the applicable technology has been demonstrated by pilot projects and is virtually certain to be implemented, or the applicable technology has been applied successfully in analogous reservoirs in the same field and is virtually certain to be implemented; (3) Development plan is available, and it will be carried out in the near future; (4) Export facilities are or will be made available. For gas, there should be an existing gas pipeline or gas pipeline construction agreement, as well as a sales contract or agreement; (5) The reserve boundaries are based on the fluid contacts confirmed by drilling or reliable pressure test data, or the lowest known hydrocarbons encountered in the well, and within the boundaries of reasonable well control; (6) The economic productivity has been demonstrated by the actual production or by conclusive test, or the productivity in the formation is confirmed by analogy with offset wells or a similar formation in the same well which has indicated economic production; (7) Feasibility studies show the development is economic based on prices and costs stipulated in the contracts or agreements and relevant economic conditions; and (8) There should be at least 80% probability that the quantities actually recovered in the future will equal or exceed the estimated EUR.
- Proved SER: refers to the difference between the Proved TUR and the Proved EUR, and includes two parts: (1) Those Proved TUR for which the feasibility studies indicate the development is sub-economic; (2) Those Proved TUR that are anticipated to be economic, but for which uncertainties in contractual and/or enhanced recovery technologies preclude such volumes being categorized as Proved EUR.

F. Development Status

20. Proved EUR is further divided into Proved Developed EUR and Proved Undeveloped EUR. Proved Developed Reserves is the difference between the Proved Developed EUR minus the Cumulative Production.

- Proved Developed EUR: refers to the Recoverable Reserves that have been put into development after the completion of well drilling and the installation of associated facilities based on an approved oil and/or gas reservoir development plan. In the case of enhanced recovery technology (e.g. water flooding), the volumes are also categorized as Proved Developed EUR when the facilities required have been completed and put into services. The Proved Developed EUR should be updated regularly during the development and production.
- Proved Undeveloped EUR: refers to the economic ultimate recovery in the oil and/or gas reservoirs/fields where the reservoir appraisal has been completed, or a production pilot has been conducted, but the development wells have not been drilled yet.

21. To estimate Recoverable Reserves with GB/T 19492-2004, TUR is calculated first, and then economic evaluation is conducted with respect to Proved TUR and/or Probable TUR to distinguish EUR and SER. Economic evaluation is not made for Possible TUR. The economic evaluation may demonstrate two cases as follows:

- If the reservoir development project is economic, the SER equals the TUR minus the EUR;
- If the reservoir development project is sub-economic, the SER equals the TUR.

II. Direct mapping of Categories and Sub-categories

A. Application of the G Axis (confidence in the geological knowledge and potential recoverability of the quantities)

22. In UNFC, the recoverable quantities and additional quantities in place within known (discovered) deposits are categorized into high, moderate and low levels of confidence, represented by G1, G2 and G3 respectively. The estimated quantities associated with deposits yet to be discovered (project in exploration stage) are categorized as G4.

23. In GB/T 19492-2004, the Geological Reserves are mainly estimated by the deterministic volumetric method, with the reservoir as the basic unit. Reserves are divided into three categories, i.e. Inferred, Indicated and Measured, in an ascending order of the overall status of reservoirs in the exploration and development phases and the geological knowledge (see Figure 2). In GB/T 19492-2004, each reservoir has an independent category of geological reserves, directly associated with its own TUR and EUR. The Measured category includes Measured PIIP, Proved TUR, Proved EUR, Proved SER and Measured UQ, all of which have a high level of confidence (G1). The Indicated category includes Indicated PIIP, Probable TUR, Probable EUR, Probable SER and Indicated UQ, all of which have a moderate level of confidence (G1+G2). The Inferred category includes Inferred PIIP, Possible TUR and Inferred UQ, all of which have a low level of confidence (G1+G2+G3). There is no category of initially in place volumes and TUR in UNFC. For completeness of GB/T 19492-2004, categories and classes of PIIP and recoverable quantities are shown in Figure 3.

Figure 3

Comparison of GB/T 19492-2004 and UNFC on the Confidence in Geological Knowledge and Potential Recoverability of the Quantities

GB/T 19492-2004 Class/Category							UNFC Category
Discovered	Measured	PIIP	Proved TUR	Proved EUR	Proved Developed EUR	Cumulative Production	Extracted Production
					Proved Developed Reserves		
				Proved Underdeveloped EUR			G1
				Proved SER			
			UQ				
	Indicated	PIIP	Probable TUR	Probable EUR		G1+G2	
				Probable SER			
			UQ				
	Inferred	PIIP	Possible TUR			G1+G2+G3	
			UQ				
Undiscovered	Prospective	PIIP	RR			G4	
			UQ				
	Unmapped	PIIP	RR				
			UQ				

24. With regard to Exploration Projects, while UNFC provides the option to sub-categorize G4.1, G4.2, and G4.3 based on geological uncertainty, under GB/T 19492-2004 these categories refer to G4 without sub-categorization; when used alone, it reflects the best estimate.

B. Detailed mapping of the E and F Axes

25. While the G Axis (confidence in the geological knowledge and potential recoverability of the quantities) expresses the uncertainty and the confidence levels within each reservoir, the detailed matrix used for the mapping of the E Axis (economic and social viability of the project) and the F Axis (field project status and its feasibility) can be seen in Figure 4. The keys and colour code are provided in Figure 5.

Figure 4

Mapping of the E-F Matrix to GB/T 19492-2004 Classes and Categories

	F1.1	F1.2	F1.3	F2.1	F2.2	F2.3	F3.1	F3.2	F3.3	F4
E1.1	1	2	3	4						
E1.2	1	2	3							
E2	4	4	4	4	5					
E3.1	12	12	12	12	12	12				
E3.2			6	6	6		8	9	10	
E3.3			7	7	7	7				11

Figure 5

Mapping of the E-F Matrix to GB/T 19492-2004. Code and Numeric Key

Class	Sub-class	Code	GB/T 19492-2004 Class and Category
Commercial Projects	On Production	1	Proved Developed Reserves
	Approved for Development	2	Proved Undeveloped EUR
	Justified for Development	3	Proved Undeveloped EUR
Potentially Commercial Projects	Development Pending	4	Proved SER, Probable EUR, Probable SER, Possible TUR
	Development on Hold	5	Proved SER, Probable EUR, Probable SER, Possible TUR
Non-Commercial Projects	Development Unclassified	6	Proved SER, Probable SER, Possible TUR
	Development Not Viable	7	Proved SER, Probable SER, Possible TUR
Additional Quantities in Place		11	Measured, Indicated and Inferred UQs
Exploration Projects	Prospect	8	Prospective RR
	Lead	9	
	Play	10	Unmapped RR
Additional Quantities in Place		11	Prospective and Unmapped UQs
Produced Not Sold		12	

26. The simplified version shown in Figure 6 shows the mapping without optional sub-classes. Note that the E and F Categories set the "minimum" standards for UNFC classes. For example, a Potentially Commercial Project must be at least E2 and F2, but it could also be E2F1.

Figure 6

Mapping Classes and Categories between GB/T 19492-2004 and UNFC

GB/T 19492-2004 Category / Class		UNFC "minimum" Category			UNFC Class
Discovered	Proved Developed Reserves, Proved Undeveloped EUR	G1	E1	F1	Commercial Projects
	Proved SER	G1	E2	F2	Potentially Commercial Projects
	Probable EUR, Probable SER	G1+G2			
	Possible TUR	G1+G2+G3			
	Proved SER	G1	E3	F2	Non-Commercial Projects
	Probable SER	G1+G2			
	Possible TUR	G1+G2+G3			
	UQ (Measured)	G1	E3	F4	Additional Quantities in Place
	UQ (Indicated)	G1+G2			
	UQ (Inferred)	G1+G2+G3			
Undiscovered	Prospective RR, Unmapped RR	G4	E3	F3	Exploration Projects
	UQ (Prospective, Unmapped)	G4	E3	F4	Additional Quantities in Place

C. Exploration projects

27. In Figure 4, four cells (8, 9, 10 and 11) in the E-F matrix show the mapping of undiscovered quantities in GB/T 19492-2004. The categories are associated with exploration projects at different stages of maturity. In UNFC, the G4 category is used for the Exploration Projects. While UNFC provides the option to expand G4 to account for uncertainty in recoverable quantities (G4.1, G4.2 and G4.3), GB/T 19492-2004 does not provide an uncertainty range, and only the best estimate is provided.

D. Additional Quantities in Place

28. Additional Quantities in Place under UNFC correspond to quantities of hydrocarbons that are currently assessed as technically un-recoverable for any class in GB/T 19492-2004. In UNFC, these volumes are classified as E3.3 F4.

III. Mapping GB/T 19492-2004 Categories to Multiple UNFC Sub-categories

29. As UNFC contains more granularity than GB/T 19492-2004, it is expected that there will be instances where a single GB/T 19492-2004 category could reflect a combination of several UNFC sub-categories. This is illustrated in Figure 4.

30. UNFC is based on three axes (E, F and G) and allows each project to be classified according to the relevant maturity. GB/T 19492-2004 does not provide a full definition of sub-classes according to a project's maturity. However, the division of classes and categories is based on the same principles: the levels of geological uncertainty and project status (E and F Axes) are closely linked and are expressed on the horizontal axis of Figure 2. Economic evaluations are included in the vertical axis of Figure 1, and mapped to the E axis. Therefore, it is possible to establish a relationship between GB/T 19492-2004 classes and categories and UNFC classes and sub-classes (Figure 4).

31. In UNFC, four classes are used for "known accumulations": "Commercial Projects", "Potentially Commercial Projects", "Non-Commercial Projects" and "Additional Quantities in Place". Previously extracted sales production quantities are not included, while non-sales production quantities are referred to as Code 12 in Figure 5.

A. Commercial projects sub-categorization

32. The Proved Developed Reserves and Proved Undeveloped EUR in GB/T 19492-2004 map to the "Commercial projects" class in UNFC. The development projects associated with the two classes of recoverable reserves are based on the approved, or economically justified, development plans. These quantities are sub-categorized as E1.1 in UNFC.

33. Proved Developed Reserves maps directly to the UNFC sub-class "On Production" (F1.1). The Proved Undeveloped EUR, with its development plan approved, maps to the UNFC sub-class "Approved for Development" (F1.2). The "Approved for Development" project requires that the capital funds have been committed and the development project is underway.

34. Proved Undeveloped EUR for which the development feasibility study has been conducted but the development plan has not been approved corresponds to the UNFC sub-class "Justified for Development" (F1.3). The "Justified for Development" project requires that a sufficiently detailed study has been conducted and the implementation of development project demonstrates the feasibility of development. The project has been demonstrated to be technically feasible, and there must be a reasonable expectation that all necessary approvals/contracts for the project to proceed to development will be forthcoming.

35. Quantities for which extraction and sales become non-profitable on the basis of current market conditions and realistic assumptions of future market conditions, but are made viable economically through government subsidies and/or other considerations, are categorized as E1.2 in UNFC. Similarly, the Proved Developed Reserves and Proved Undeveloped EUR map to E1.2.

36. Associated quantities derived from Proved Developed Reserves, Proved Undeveloped EUR, Proved SER, Probable EUR, Probable SER, and Possible TUR that are forecast to be extracted, but will not be available for sale will be linked to Sub-category E3.1 in UNFC. The project sub-category (F axis) will be the same as for associated quantities being extracted and sold. The level of geological uncertainty is also reflected in the project uncertainty.

B. Potentially Commercial and Non-Commercial Projects

Sub-categorization

37. The Proved SER, Probable EUR, Probable SER and Possible TUR in GB/T 19492-2004 correspond to the UNFC sub-class “Potentially Commercial Projects”. These four classes of recoverable reserves are reasonably expected to become commercially recoverable through oil price rise or change of other economic parameters, technical advancement or improvement of other conditions, thus they can be assigned to E1 and E2 in UNFC. They mainly involve the following three types of projects:

- Projects that contain Proved SER associated with Proved EUR by detail development feasibility study, after the completion of Reservoir Appraisal phase;
- Projects that are demonstrated by the preliminary development feasibility study to contain Probable EUR and Probable SER above the threshold of marginal economics, in latter stage of General Exploration phase;
- Projects that contain Possible TUR, after the oil and/or gas has been discovered, and where the potential for upgrading has been established and the evaluation activities for upgrading are in progress.

38. During the General Exploration phase, the Possible TUR and Probable SER in GB/T 19492-2004 may be classified as “Non-Commercial Projects” in UNFC. Those are referred to as Sub-category E3 in UNFC. In due time, the economic condition may be updated based on new information. UNFC categories will include either: reasonable prospects for economic extraction and sale in the foreseeable future (E2), economic viability cannot be determined due to insufficient information (E3.2), or it is currently considered that there are no reasonable prospects in the foreseeable future for economic extraction and sale (E3.3), on the basis of realistic assumptions of future market conditions.

39. With regard to project maturity, there are either project activities ongoing to justify development in the foreseeable future (F2.1), or project activities are on hold (F2.2), or there are no current plans to develop or acquire additional data due to limited potential (F2.3).

40. Mapping to the UNFC Categories and Sub-categories is based on the following principles:

- Development Pending projects must, as a minimum, satisfy the definitions of both F2.1 and E2. A project that meets all technical requirements but does not meet the current economic threshold (no approved Development Plan) can be referred to as F1.3. A project with unresolved technical feasibility issues is referred to as F2.1, but if there are no doubts about commercial viability, it could still satisfy the definition of E1.1.
- Development On Hold projects are similar to Development Pending projects, but their progress in commerciality is constrained by activities which may be controlled by or outside the control of the evaluator. Projects on Hold are categorized as F2.2 to reflect the chance of commerciality but taking into account the current lack of activity progress.
- Development Unclassified projects are those where there is currently an insufficient basis for concluding that there are reasonable prospects for eventual economic extraction. This is generally caused by lack of data for making an assessment, or by evaluation being at an early stage. The projects are sub-categorized as E3.2 and as F1.3, F2.1 or F2.2 based on the level of technical maturity.

- Development Not Viable projects are potentially technically feasible projects (based on existing technology or technology currently under development), but they have been assessed as being of insufficient potential to warrant any further data acquisition activities or any direct efforts for eliminating commercial contingencies at the moment. In such cases, it can be helpful to identify and record these quantities as part of a portfolio so that in the event of a major change in commercial conditions it is possible to re-evaluate their potential for commercial development. These projects are considered to have insufficient potential for possible commercial development in the foreseeable future and are therefore always referred to as the E3.3 sub-category in UNFC. Typically, these projects will not be technically mature due to the lack of potential and can be subcategorized as F2.3. However, there can be circumstances where, for example, the project has been improved to F1.3 and the commercial circumstances changed significantly.

41. The Probable EUR and Possible TUR in GB/T 19492-2004, for which the reservoir appraisal is underway and the economics are clarified, can be mapped to E1.1F2.1, and the Probable SER associated with Probable EUR is mapped to E2F2.1 or E3F2.1. For a project that is uneconomic currently due to uncontrollable factors, such as a drop in oil and gas prices, Proved SER could be mapped to E2F1.1 if the production of the reservoir has started or to E2F1.2 if the development plan for the project has been approved or is being implemented. The Proved SER estimated is mapped to E2F1.3 if the development plan for the project has not been approved.

42. In the case where there are reasonable prospects for economic extraction and sale in the foreseeable future (E2), but project implementation is on hold, the Proved SER that is estimated from the completion of Reservoir Appraisal phase, and the Probable EUR, Probable SER and Possible TUR that are estimated during General Exploration phase are mapped to E2F2.2 “Development On Hold” in UNFC.

43. The Proved SER and Probable SER that are lower than the threshold of marginal economics, and the Possible TUR with its economics to be determined in GB/T 19492-2004, are mapped to sub-classes of the UNFC “Non-commercial Projects”. In the case where the economic viability of their extraction cannot be determined due to insufficient information (sub-category E3.2), these categories of reserves should be mapped to the sub-class of “Development Unclassified”. They can be mapped to one of the categories F1.3, F2.1 and F2.2 in UNFC. The Proved SER for which the reservoir appraisal is completed, and it is technically feasible is mapped to F1.3. The Probable SER and Possible TUR for which plans are available for new data acquisition are mapped to F2.1; if the appraisal is delayed, both categories are mapped to F2.2. If it is considered, based on realistic assumptions of future market conditions, that there are no reasonable prospects for economic extraction of reserves of these categories in the foreseeable future (sub-category E3.3), these categories of reserves are mapped to sub-class “Development Not Viable”.

44. In the E-F matrix, E3.1 represents the non-sales production quantities and is expressed as a numeric symbol – 12. It is not defined in GB/T 19492-2004 but included in the category of EUR. This is different from UNFC (see paragraph 51 for details).

IV. Mapping of the Exploration and Development Phases in GB/T 19492-2004 to UNFC Classes

45. In GB/T 19492-2004, the classification is mainly associated with the exploration and development phases, rather than project maturities directly. To some extent, this

classification in GB/T 19492-2004 is in line with the project classification in UNFC, with the mapping relationship as shown in Figure 7.

Figure 7

Mapping of Exploration and Development Phases in GB/T 19492-2004 to Classes/Sub-classes in UNFC

GB/T 19492-2004			UNFC	
Reserves and Resources Class and Classification of Phases/Projects			Class	Sub-class
Discovered	Measured (Developed)	Production Operation Phase / Enhanced Recovery Projects	Commercial Projects	On Production
	Measured (Undeveloped)	Development Construction Phase / Development Construction Projects		Approved for Development
		Reservoir Appraisal Phase / Appraisal Projects		Justified for Development
	Indicated	General Exploration Phase / General Exploration Projects	Potentially Commercial Projects	Development Pending or On Hold
	Inferred		Non-Commercial Projects	Development Unclassified or Not Viable
Undiscovered	Prospective		Exploration Projects	Prospect
	Unmapped	Regional Survey Phase / Risk Exploration Projects		Lead
				Play

46. Note that at the Reservoir Appraisal phase there is already a good understanding of the reservoir and the development plan has been identified. However, some details of the design have not yet been finalized, and the development plan has not yet been approved.

47. While the project maturity in UNFC determines the commerciality of Recoverable Quantities, the classification of exploration and development phases in GB/T 19492-2004 determines the classes of reserves and resources. When the exploration and development phases of projects take place, their commercial maturity evolves, and the confidence and commercial levels of the associated reserves and resources improve. In GB/T 19492-2004, the Regional Survey phase is equivalent to risk exploration projects, the General Exploration phase is linked to general exploration projects, the Reservoir Appraisal phase corresponds to reservoir appraisal projects, the Development Construction phase to development projects, and the Production Operation phase mainly to enhanced recovery projects; they have mapping relationships with the classes and sub-classes in UNFC.

48. The appraisal projects, development construction projects and enhanced recovery projects are mapped to the “Commercial Projects” in UNFC. The enhanced recovery projects include infill wells, water (steam) injection, gas injection and polymer injection, so they are mapped to the sub-class of “On Production” in UNFC. The development construction projects are equivalent to the Proved Undeveloped reserves for which the development plan has been approved and/or the production capacity is in construction, so they are mapped to the sub-class of “Approved for Development” in UNFC. The final results of reservoir appraisal projects are Measured (undeveloped) reserves which correspond to the completion of preparing the development plan. These projects are mapped to the sub-class of “Justified for Development” under the “Commercial Projects” in UNFC.

49. The general exploration projects are mapped to “Potentially Commercial Projects”, “Non-Commercial Projects” and “Exploration Projects” in UNFC. The Indicated PIIP, Inferred PIIP and Prospective PIIP are derived from the general exploration projects. The Indicated PIIP is mainly mapped to the sub-class of “Development Pending” or “Development On Hold” under “Potentially Commercial Projects” in UNFC. The Inferred PIIP is mainly mapped to the sub-class of “Development Unclassified” or “Development Not Viable” under “Non-Commercial Projects” in UNFC. The Prospective PIIP is mapped to the sub-classes of “Prospect” and “Lead” under the “Exploration Projects” in UNFC.

50. The risk exploration projects are mapped to the sub-class of “Play” under the “Exploration Projects” in UNFC. The Unmapped PIIP can be obtained from the risk exploration projects.

V. Undefined and Unclassified Quantities in GB/T 19492-2004

51. As noted above, UNFC specifies that all non-sales quantities (lease fuel, flare and losses) may be separately identified and documented in addition to sales quantities. When needed to differentiate lease fuel and flare and losses within UNFC, quantities of each non-sales type should be accounted as a different product type (see UNFC Generic Specification D) and reported separately. Non-sales quantities are not defined and classified in GB/T 19492-2004.
