PRESENTATION OF

USE OF PERFORMANCE ASSESSMENT IN THE EVALUATION AND LICENSING OF HIGH-LEVEL WASTE DISPOSAL

TO

NATIONAL ACADEMY OF SCIENCES
COMMITTEE ON THE TECHNICAL BASES FOR YUCCA MOUNTAIN STANDARDS
DECEMBER 1993

BY

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INTRODUCTION

MAJOR TOPICS ADDRESSED IN THIS PRESENTATION INCLUDE;

* ROLE OF PA IN THE REGULATORY CONTEXT
* SOURCES OF UNCERTAINTY
* USE OF PA TO TREAT UNCERTAINTY
* THE REGULATORY FRAMEWORK
* IMPACT OF POTENTIAL REVISIONS TO THE EPA STANDARD FOR YUCCA MOUNTAIN
* CONCLUSIONS

ROLE OF PA IN THE REGULATORY CONTEXT

* LINKS VAST QUANTITY OF DATA TO REGULATORY DECISION-MAKING

* PROVIDES MEANS TO QUANTIFY MAGNITUDE AND LIKELIHOOD OF POTENTIAL HEALTH, SAFETY, AND ENVIRONMENTAL EFFECTS OF A NUCLEAR WASTE REPOSITORY

* PROVIDES DISCIPLINED PROCESS TO COMPARE POTENTIAL EFFECTS TO REGULATORY STANDARDS

  - DOE REQUIRED TO PROVIDE COMPREHENSIVE PA IN LICENSE APPLICATION

  - NRC WILL CONDUCT COMPREHENSIVE REVIEW USING INDEPENDENT CALCULATIONS FOCUSING ON KEY PERFORMANCE ASSUMPTIONS

* AFFORDS AN UNDERSTANDING OF THE PERFORMANCE OF ELEMENTS OF THE OVERALL SYSTEM TO ALLOW OPTIMIZATION OF THOSE ELEMENTS AND ASSURANCE THAT OVERALL PERFORMANCE OBJECTIVE IS ACHIEVED

* PROVIDES MEANS OF GUIDING SITE CHARACTERIZATION AND FOCUSING ATTENTION ON ISSUES THAT ARE OF THE GREATEST SAFETY SIGNIFICANCE

** AFFORDS AN OPPORTUNITY TO SYSTEMATICALLY REFLECT ON ADEQUACY OF PERFORMANCE CRITERIA AND REGULATORY FRAMEWORK

SOURCES OF UNCERTAINTY IN DEMONSTRATION OF LONG-TERM SAFETY AND EFFICACY OF REPOSITORY

CATEGORIES OF UNCERTAINTY

* REGULATORY UNCERTAINTY
  - DOUBT ABOUT WHAT MUST BE PROVEN TO DEMONSTRATE COMPLIANCE
  - NRC HAS INITIATIVE UNDERWAY TO CORRECT THESE UNCERTAINTIES
* TECHNICAL UNCERTAINTY
  - INCOMPLETE TECHNICAL KNOWLEDGE REGARDING REPOSITORY SYSTEMS, IMPERFECT ABILITY TO PREDICT FUTURE STATES AND TO MODEL REALITY
  - UNAVOIDABLE IN PROJECTIONS OF REPOSITORY PERFORMANCE OVER LONG TIME PERIODS
  - SITE CHARACTERIZATION IS KEY TO REDUCING TECHNICAL UNCERTAINTY
  - NRC ENCOURAGES USE OF PA TO GUIDE SITE CHARACTERIZATION TO
    * ACQUIRE ESSENTIAL INFORMATION
    * MINIMIZE SITE DISRUPTION

USE OF PA TO TREAT UNCERTAINTY

* EARLY, ITERATIVE PROCESS IS KEY TO REDUCING UNCERTAINTY

* PA AFFORDS OPPORTUNITY TO;

  - IDENTIFY & EVALUATE MODELING ASSUMPTIONS

  - EVALUATE DATA UNCERTAINTIES ON ESTIMATES OF REPOSITORY PERFORMANCE

  - UNDERSTAND IMPACT OF UNCERTAINTY IN FUTURE STATES OF NATURE ON ESTIMATES OF REPOSITORY PERFORMANCE

  - EVALUATE IMPACTS OF ALTERNATIVE CONCEPTUAL MODELS ON PREDICTED PERFORMANCE

* PA CANNOT ELIMINATE ALL UNCERTAINTY;

  "RESIDUAL UNCERTAINTY" MUST BE ADDRESSED THROUGH THE LICENSING PROCESS

* PA HAS A CONTINUAL ROLE IN PERFORMANCE CONFIRMATION PROGRAM TO PROVIDE ADDITIONAL ASSURANCE ABOUT REPOSITORY PERFORMANCE

THE REGULATORY FRAMEWORK

NATIONAL COMMITMENT TO DEEP GEOLOGIC DISPOSAL CODIFIED IN EXISTING LEGISLATION

FUNDAMENTAL PREMISE SUPPORTING THIS COMMITMENT:

DISPOSE OF WASTE IN A MANNER SUCH THAT FUTURE GENERATIONS WILL NOT BE EXPOSED TO RADIATION HAZARDS THAT WE WOULD NOT FIND UNACCEPTABLE FOR OURSELVES TODAY.

EXISTING REGULATORY FRAMEWORK CALLS FOR:

* NRC TO CONFORM REGULATIONS TO EPA STANDARDS
* NRC TO EVALUATE DOE'S COMPLIANCE WITH NRC'S REGULATIONS
* NWPA REQUIRES MULTIPLE BARRIER APPROACH & RESTRICTIONS ON RETRIEVABILITY AS APPROPRIATE
* CONSISTENT WITH THIS MANDATE, NRC ESTABLISHED 3 SUBSYSTEM PERFORMANCE OBJECTIVES FOR REPOSITORY BARRIERS

SUBSYSTEM PERFORMANCE OBJECTIVES

* COMMISSION SOUGHT TO DEFINE SIMPLER MEASURES OF SUBSYSTEM PERFORMANCE WHICH, IF MET, WOULD ENHANCE CONFIDENCE THAT THE OVERALL PERFORMANCE OBJECTIVES COULD BE MET

* NRC'S SUBSYSTEM PERFORMANCE OBJECTIVES FOR BARRIERS PRESCRIBE:
  - LENGTH OF TIME FOR SUBSTANTIALLY COMPLETE CONTAINMENT
  - ACCEPTABLE FRACTIONAL RELEASE RATE FROM EBS
  - LIMIT ON PRE-EMPLACEMENT GROUNDWATER TRAVEL TIME

* COMMISSION RECOGNIZED THE NEED FOR FLEXIBILITY IN APPLYING SUBSYSTEM CRITERIA THROUGH 60.113B (ALTERNATIVE RELEASE STANDARDS, TRAVEL TIMES, AND WASTE PACKAGE CONTAINMENT PERIODS MAY BE APPROVED BY THE COMMISSION ON A CASE-BY-CASE BASIS)

* NRC STAFF IS ACTIVELY RE-EXAMINING THESE CRITERIA TO ENSURE THAT THEY ARE APPROPRIATE MEASURES OF SUBSYSTEM PERFORMANCE

VIEWS ON HEALTH BASED STANDARDS

* CAN BE DEVELOPED BY EPA WITH NAS GUIDANCE

* AN INDIVIDUAL PROTECTION STANDARD SHOULD NOT ATTEMPT TO PROTECT ALL INDIVIDUALS, UNDER ALL CIRCUMSTANCES, AT ALL TIMES IN FUTURE

* FOR A POPULATION DOSE STANDARD, IT MAY BE APPROPRIATE TO TRUNCATE SUMMATIONS OF INDIVIDUAL DOSES, EITHER AS A FUNCTION OF DISTANCE FROM REPOSITORY OR AT SOME "NEGLIGIBLE RISK" INDIVIDUAL DOSE RATE

* CLEAR ADVANTAGES TO A DERIVED STANDARD IF RELEVANT ASSUMPTIONS ARE USED IN DERIVATION ESTABLISHING CLEAR LINK TO SAFETY OBJECTIVES

* DOSE LIMITS ARE MORE DIFFICULT TO IMPLEMENT IN LICENSING REVIEW THAN RELEASE LIMITS BECAUSE ASSUMPTIONS MUST BE MADE ABOUT LONG TERM POPULATION LOCATIONS AND LIFESTYLES

* PREFER THAT EPA REVISE RELEASE LIMITS OR DERIVE NEW ONES DEMONSTRABLY LINKED TO HEALTH & SAFETY OBJECTIVES INSTEAD OF DEVELOPING DOSE OR RISK STANDARD

VIEWS ON CURRENT STANDARDS

* RELEASE LIMITS NOT APPROPRIATE IF APPLIED TO SITE-SPECIFIC CONDITIONS NOT ENCOMPASSED WITHIN RANGE OF GENERIC ASSUMPTIONS USED TO DERIVE RELEASE LIMITS

* ANY JUDGEMENT OF "TECHNICAL UNCERTAINTY" SHOULD INCLUDE ASSESSMENT OF LEVEL OF PROTECTION

* ASSUMPTIONS UNDERLYING CURRENT RELEASE LIMITS MAY RESULT IN UNWARRANTED CONSERVATISM

  - "REVEALED STRINGENCY" (EG C-14)

  - "VEILED STRINGENCY" (EG I-129)

* NRC HAS EXPRESSED CONCERN ABOUT TECHNICAL BASIS OF INDIVIDUAL AND GROUNDWATER PROTECTION REQUIREMENTS

* REALISTIC ESTIMATES OF REPOSITORY PERFORMANCE SHOULD NOT BE COMPARED TO "ZERO RISK" BUT INSTEAD TO A LEVEL OF PROTECTION ONE WOULD FIND ACCEPTABLE TODAY

IMPACTS OF POTENTIAL REVISIONS TO THE EPA STANDARD FOR YUCCA MOUNTAIN

* AN APPROPRIATELY DERIVED LIMIT ON RELEASES WOULD BE EASIER TO IMPLEMENT DURING LICENSING THAN DOSE OR RISK STANDARD

* ANY DOSE STANDARD SHOULD EXPLICITLY INCLUDE SOME SPECIFICATION OF REFERENCE BIOSPHERE TO AVOID POTENTIAL FOR UNDUE SPECULATION DURING LICENSING

* ADOPTION OF DOSE OR RISK STANDARD WOULD NECESSITATE EXPANSION OF ONGOING PA'S

* DOSE OR RISK STANDARD MAY REQUIRE ADDITIONAL SITE CHARACTERIZATION EFFORTS BY DOE AND CORRESPONDING REVIEW EFFORTS BY NRC; DOE MAY NEED TO MORE PRECISELY ESTIMATE CONCENTRATIONS, RATES AND TIMING OF RADIONUCLIDE RELEASE

* RELIANCE ON POST-CLOSURE OVERSIGHT AS MANDATED BY ENERGY POLICY ACT WILL NECESSITATE LICENSING REVIEW OF DOE CONTINGENCY PLANS FOR REMEDIATION

CONCLUSIONS

* PA PROVIDES A DISCIPLINED PROCESS TO LINK THE VAST QUANTITY OF DATA THAT WILL BE OBTAINED ABOUT A REPOSITORY PROVIDED:

  - ALL SCIENTIFIC DISCIPLINES QUANTIFY REPOSITORY BEHAVIOR TO THE EXTENT IT CAN BE SUBSTANTIATED INCLUDING RESIDUAL UNCERTAINTY

  - MODELERS INCORPORATE QUANTITATIVE & QUALITATIVE INFORMATION FROM ALL APPROPRIATE SCIENTIFIC DISCIPLINES ACCURATELY REFLECTING THE CURRENT STATE OF KNOWLEDGE

  - REGULATORY DECISION-MAKERS HONESTLY ACKNOWLEDGE, ACCEPT, AND COMMUNICATE THE LIMITATIONS OF CERTAINTY INVOLVED IN PREDICTING PERFORMANCE

* PA IS A POWERFUL ANALYTICAL TOOL WHICH CAN PROVIDE SIGNIFICANT SUPPORT FOR REGULATORY DECISIONS ABOUT REPOSITORY PERFORMANCE

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

YUCCA MOUNTAIN PROJECT

KTI Planning Strategy for December 20004 License Application

Presented to:
US Nuclear Regulatory Commission

Presented by:
Mark Wisenburg
BSC License Application Project

April 15, 2002
Las Vegas, NV

Work Scope –
Post LA agreements
Bin 3 – risk informed not risk-based

Key Technical Issue Agreement Summary

(reflects activities through April 9, 2002)

KTI ID	Agreements Reached (1)	Documentation Received for Agreement (3)	Documentation Partly Received for Agreement (4)	Documentation Not Received for Agreement	Need Additional Information (5)	Agreements Complete (2)
USFIC	27	0	1	22	0	4
IA	22	0	1	14	0	7
CLST	58	1	3	32	13	9
SDS	10	4	2	0	3	1
RT	29	1	2	22	2	2
ENFE	41	3	7	19	2	10
TEF	15	1	4	5	1	4
RDTME	23	0	2	21	0	0
TSPAI	58	0	0	57	0	1
PRE-C**	9	0	0	9	0	0
GEN	1	0	0	1	0	0
TOTAL	293	10	22	202	21	38

** Note: Pre-closure Safety is not considered a Key Technical Issue, but is listed as a topic of interest to the NRC.

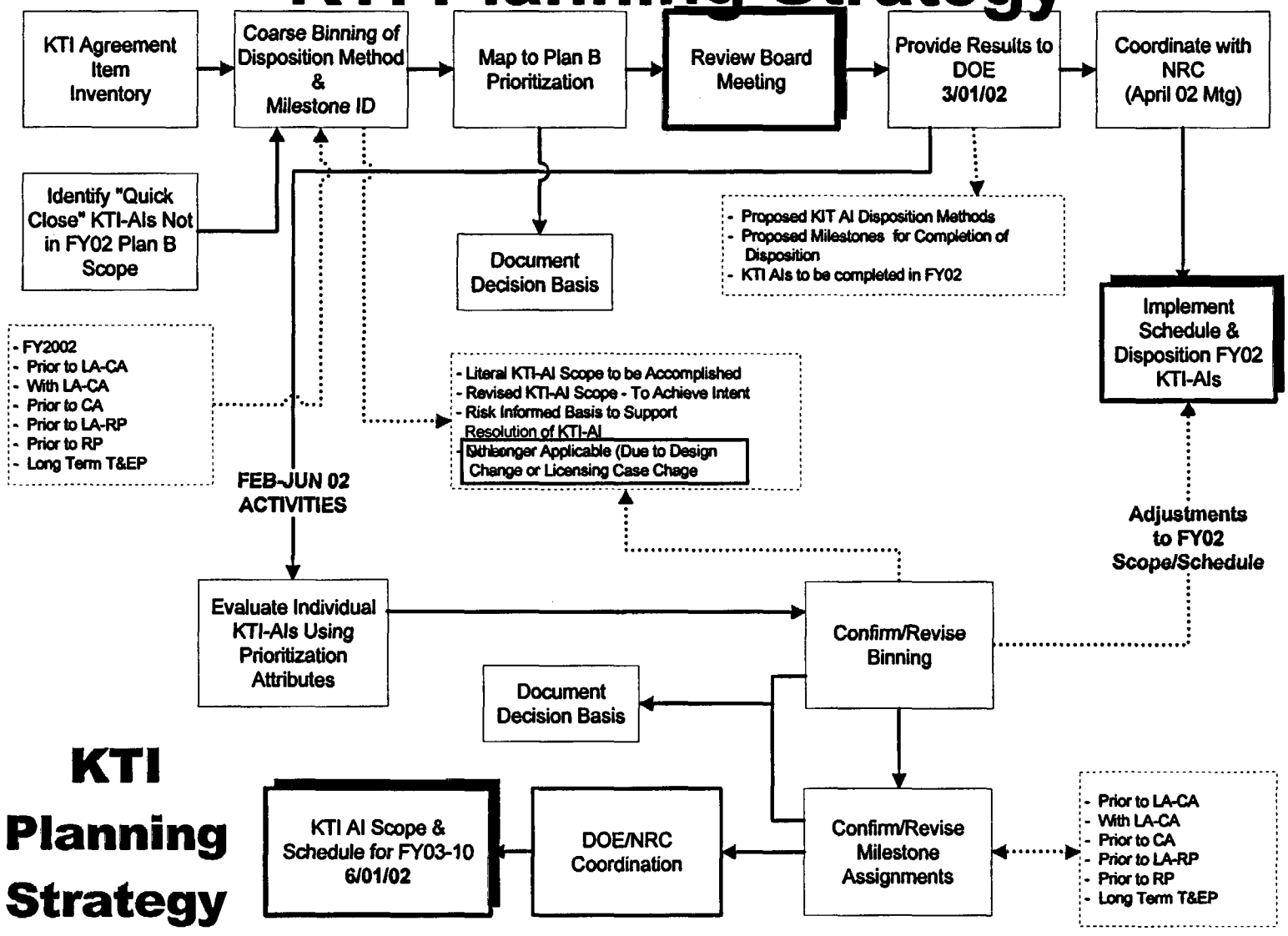
1. The total of agreements reached between NRC and DOE at technical exchange meetings.
2. Agreements closed by NRC for which it has reviewed all documentation and has no further questions.
3. Agreements for which NRC has received all documentation but has not completed its review.
4. Agreements for which NRC has received a portion of the documents agreed to.
5. Agreements for which NRC has received complete or partial documentation, but has requested further information via a formal letter.

Have - Enhanced FEP plan - 4-5-02

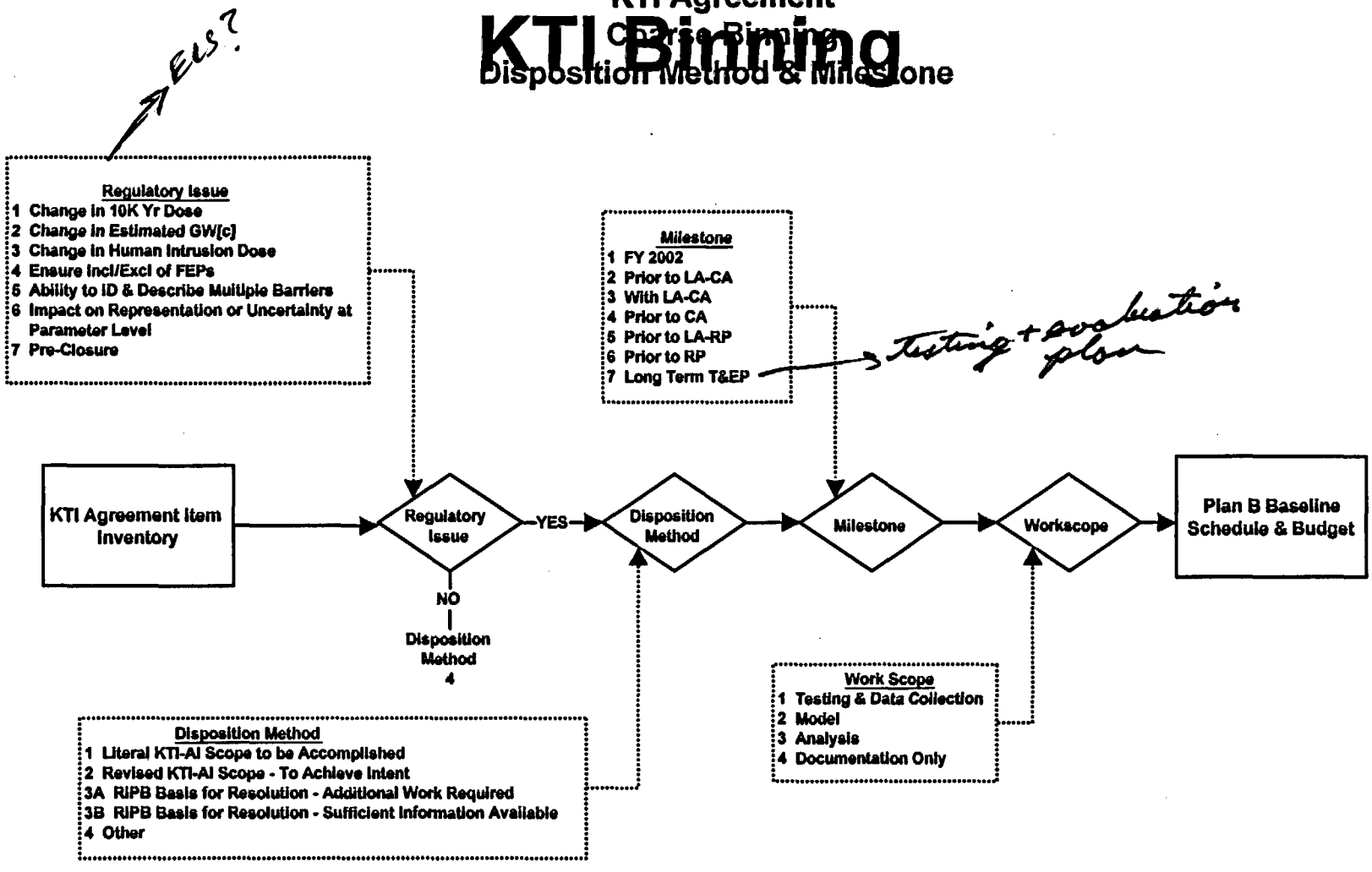
Key Technical Issues

- Prelicensing consultations on Key Technical Issues with NRC resulted in 293 agreement items
- Items currently being prioritized based on their risk significance
- All agreement items will be resolved at LA submittal but some will not be completed till later when, what basis?
- Some agreement items have been overcome by events based on new project approaches

KTI Planning Strategy



KTI Agreement
Coarse Binning
Disposition Method & Milestone



Definitions for Disposition Bins

- **Complete** All sub-components of a KTI agreement are statused by the NRC as received, superceded by another agreement, or complete and there is no outstanding request for additional information (RAI) from the NRC. In the event NRC subsequently issues a RAI against a KTI agreement statused as complete, that KTI agreement will be reopened and statused accordingly.

- **Bin 1 – Literal KTI-AI Scope to be Accomplished** Additional analyses, modeling, data collection, testing or documentation will be provided to the NRC as specified and documented in the original KTI agreement during an NRC/DOE Technical Exchange. While the scope will be the same as stated in the original agreement, the schedule for submittal of the information to the NRC may be changed.

Definitions for Disposition Bins

- **<u>Bin 2 – Revised KTI-AI Scope – to Achieve Intent</u>**
  Additional analyses, modeling, data collection, testing or documentation will be provided different from that specified and documented in the original KTI agreement during an NRC/DOE Technical Exchange. Even though the scope of information to be provided will be different than that originally documented in the KTI agreement during an NRC/DOE Technical Exchange (e.g., because of new information or a more efficient approach), DOE expects that the intent of the original agreement will be achieved. The schedule for submittal of the information to the NRC may also be changed from that stated in the original agreement.

Definitions for Disposition Bins

- **Bin 3 – Risk Informed Performance Based Basis to Support Resolution of KTI-AI** Additional analyses and documentation that includes risk information will be provided to the NRC as an alternative basis for closure of the KTI agreement. Generally the risk information will demonstrate that the subject of the original KTI agreement does not contribute significantly to overall system performance. This disposition method will be used only where the risk information provides a rigorous and comprehensive justification for resolution of the KTI agreement.

Definitions for Disposition Bins

- **Bin 4 – Other** DOE considers there is a basis for resolution as a result of changed circumstances, e.g., a change in design or licensing basis.

KTI Agreement Item Disposition Bins

Bin #	Disposition Method Bin
1	Literal KTI-AI Scope to be Accomplished
2	Revised KTI-AI Scope - To Achieve Intent
3A	Risk Informed Basis to Support Resolution of KTI-AI / Additional Work Required
3B	Risk Informed Basis to Support Resolution of KTI-AI / Sufficient Information Available
4	Other
C	Complete

KTI Agreement Item Milestone Bins

Milestone #	Milestone
1	FY 2002
2	Prior to LA-CA
3	With LA-CA
4	Prior to CA
5	Prior to LA-RP
6	Prior to RP
7	Long Term T&EP

KTI Binning Summary

which ones

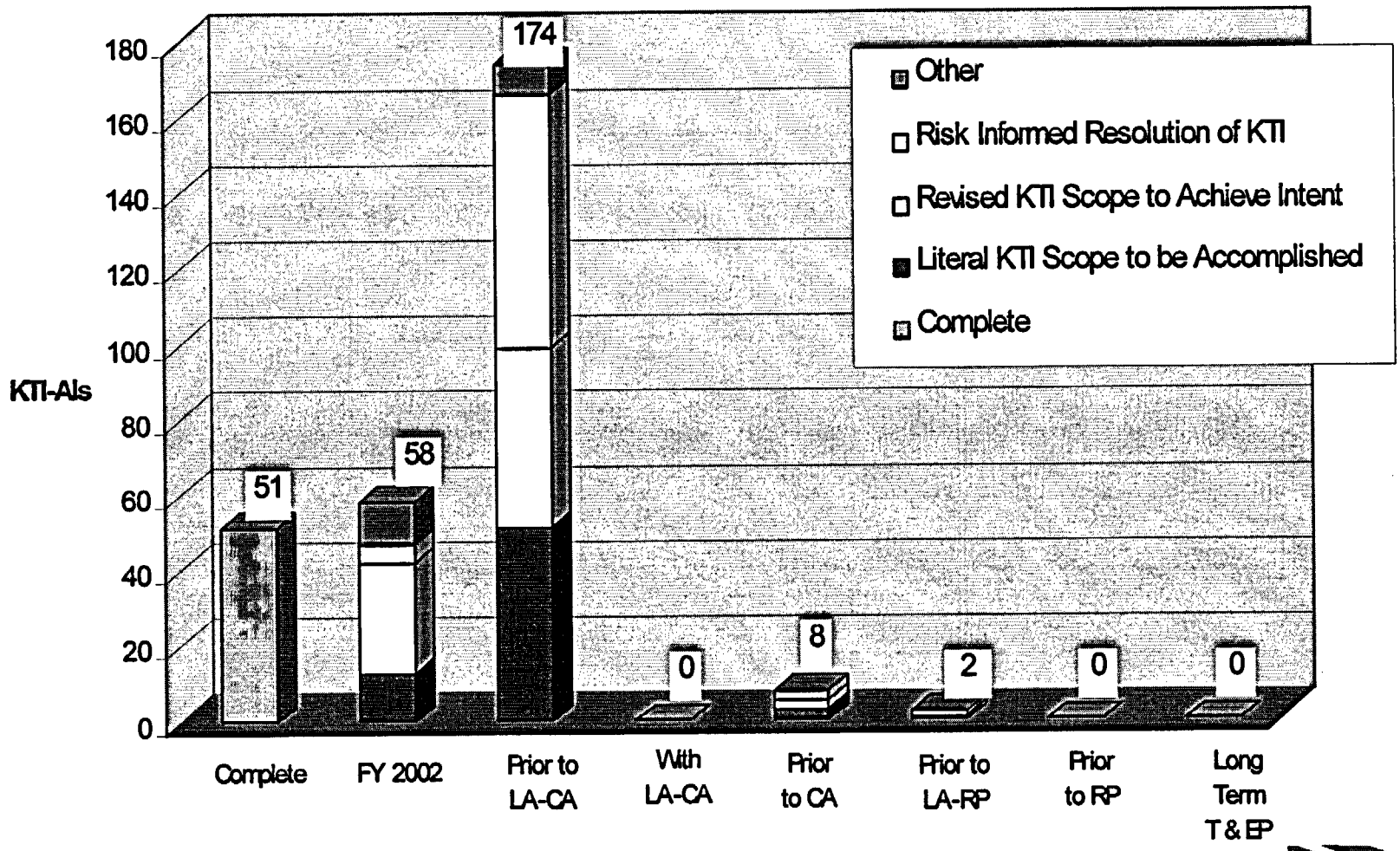
Disposition Method	Milestone								Total
	Complete	FY 02	Prior to LA-CA	With LA-CA	Prior to CA	Prior to LA-RP	Prior to RP	Long Term	
Complete	51	0	0	0	0	0	0	0	51
Literal Scope	0	13	51	0	3	0	0	0	67
Revised Scope	0	29	48	0	2	1	0	0	80
RIPB Resolution	0	5	67	0	3	1	0	0	76
Other	0	11	8	0	0	0	0	0	19
									293
Total	51*	58	174	0	8	2	0	0	293

will provide info in hand at time of LA

*Includes 38 KTI Agreement Items statused as "Complete" by the NRC and 13 KTI Agreement Items submitted by DOE for NRC review.

would be available before "expected" hearing start

KTI Agreement Items by Milestone



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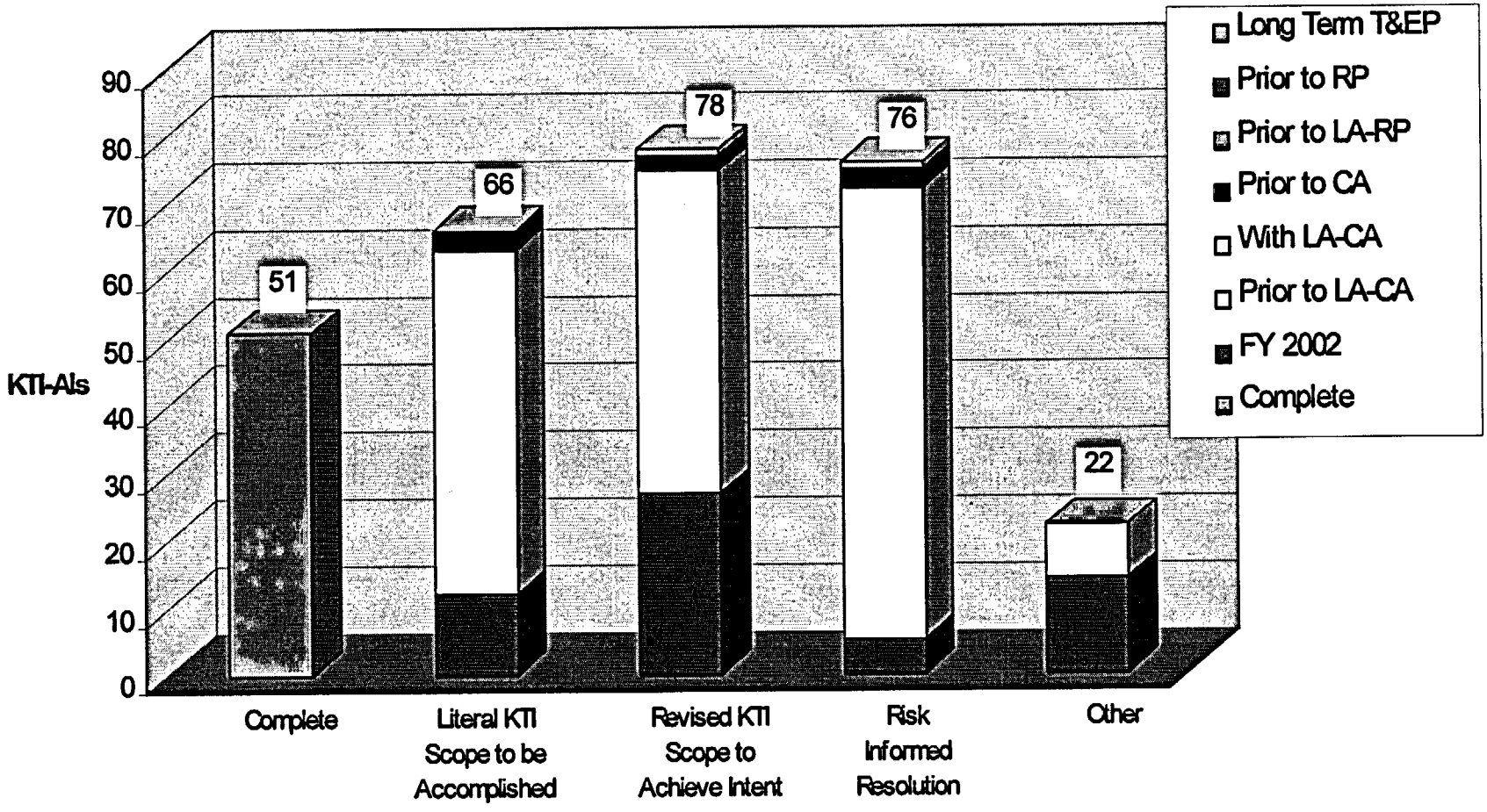
KTI Agreement Items by Disposition Bin