Uranium Recovery Licensing Workshop
License Application Preparation

December 17, 2009

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Basic Application Submittal

- Technical Report (TR)
- Environmental Report (ER) (Per 10 CFR Part 51)
- Form 313
  - Required for new facilities, expansions
  - Also required for all amendments

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Other Applications/Timing

- BLM, USFS, States, EPA
- Submit Applications to other agencies at same time as NRC application
- Might facilitate environmental review

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Review Process

- Acceptance Review – starts at application receipt.
- Decision on acceptance
- TR – requests for additional information (RAIs)
- Draft SER – supports RAIs
- Open Issues Resolution
- Final SER

Review Process (cont'd.)

- Acknowledge Receipt – 11 days after URLB receives application
- Acceptance Review – 90 days after acknowledgement
- Draft Safety Evaluation Report (SER) & requests for additional information (RAIs) – min. 185 days after acceptance
  - Draft SER – supports RAIs
  - No partial submittals of RAI responses
- Final SER – 180 days after receiving complete RAI respsonses.

Review Process (cont'd.)

Interactions

- Preapplication
  - Meetings
  - Site visits
  - If quarterly meetings, cover different area each time
  - Telephone calls to NRC PM
- Technical Review Phase
  - Public meeting to discuss RAIs
  - Telephone calls to NRC PM

Review Process (cont'd.)

Interactions

- RAI response phase
  - Public meeting to discuss RAIs responses
  - Telephone calls with the PM
- Open issue phase
  - Public meetings to discuss open issue responses, meeting summary
  - Telephone calls with the PM

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Technical Report

- Organize the TR same as NUREG-1569 and/or -1620, as appropriate
- Provide Checklist
  - Based on NUREG-1569 and/or -1620 acceptance criteria
  - Confirm information is present
  - Provide location of information

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Technical Report

- Technical Report vs. Environmental Report
  - ER can reference certain information in TR
  - Geology
  - Hydrogeology
  - Surface Water
  - Soils
  - Meteorology
- Environmental impacts are solely discussed in the ER.

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Technical Report

Data vs. Assumptions

- Certain aspects of an application are amenable to data collection; Others are not.
- When data can't be collected, make conservative assumptions.
- Commitment to confirm assumptions

Technical Report

Types of information

- Data/Analysis
- Commitments
  - Need to commit to complying with regulations and demonstrate how compliance will be accomplished
  - Commitments to other conditions.

Section 1.0

- Corporate entities
- Location of facilities
- Ore body location
- Land Ownership
- Proposed milling/extraction method
- Schedules
- Groundwater restoration, decomm, reclamation plans
- Surety arrangements
- Waste management strategy
- Previous experience

Section 1.0 (cont'd.)

- State if foreign owned
  - No prohibition against foreign ownership of UR facilities
- Alternate schedule for ISRs
  - timeliness in decommissioning for groundwater
  - 10 CFR 40.42(f)
- Identify Federal or state owned land
  - Identify agencies
  - Permits
  - Approximate application submission time (helpful, not necessary).
- Schedules for groundwater restoration, decomm, reclamation plans

Section 2.0, Subsection 2.1

Site Location and Layout

- Maps showing facility features
- ID unusual site features, previous activities
- Show restricted areas and site boundary
- Show expected wellfield boundaries
  - Full extent of activities
  - Does not need to be final boundaries – conservative

Section 2.0, Subsection 2.2

Meteorology

- Purpose
  - assess public doses
  - properly locate monitoring stations
- Methods
  - Onsite meteorological measurements
  - Measurements from a nearby station

Section 2.0, Subsection 2.2

Meteorology (cont'd.)

- Onsite measurements should be consistent with RG 3.63.
  - Parameters – wind direction and speed, humidity, temp, precipitation, stability class, joint distribution
  - Comparison of monitoring data to existing NWS station
- Offsite meteorological data
  - If offsite meteorological data use, need to provide analysis of representativeness to the site.

Section 2.0, Subsection 2.3

Geology, Seismology, Soils

- Local and regional geology
- Stratigraphy, structure, confinement, ore
- Cross-sections with logs
- Previous investigations, cross-sections
- Identify unusual geologic conditions

Section 2.0, Subsection 2.4

Hydrology, Groundwater and Surface Water

- Hydraulic properties and confinement of ore zone aquifer, surficial, overlying, and underlying.
- Assessment of groundwater availability
- Assess groundwater quality (i.e. radionuclides and chemical)
- Pumping tests, sufficient monitoring network
- ID unusual conditions – unconfined aquifers, missing confining layers

Section 2.0, Subsection 2.4

Hydrology, Groundwater and Surface Water

- Surface water onsite and offsite
- Discuss nexus to surface water bodies
- Assessment of surface water quality and quantity
  - ID and justify surface water sampling points
  - If no samples can be collected, explain.
  - Stream flow statistics
- Erosion and flooding potential
- Surface water uses

Section 2.0, Subsection 2.4

Hydrology, Groundwater and Surface Water

- Groundwater Models
  - Not required, but answer many questions
  - Do not need to be overly complex
  - Run scenarios and perform ML analysis
- Models can assess restoration – estimate pore volumes for surety
- If models are prepared, provide the input files

Section 2.0, Subsection 2.4

Hydrology, Groundwater and Surface Water

- Water supply affects
  - ID water uses near the facility
  - Determine connectivity of supply wells to extraction zone
  - Determine drawdown at supply wells
  - Determine surface water interactions

Section 2.0, Subsection 2.4

Hydrology, Groundwater and Surface Water

- Water quality
  - List of parameters in NUREG-1569
  - Include radon, if possible
  - 4 quarters of sampling
  - Well spacing should be sufficient to characterize entire site
- Well drilling is limited by 10 CFR 40.32(e)
- Installation of wellfield monitoring networks is prohibited.

Section 2.0, Subsection 2.5

Background Characteristics

- Radiological and Chemical
- Purpose is to provide sufficient baseline to support conclusions that site has been restored after operations
- Refer to Reg Guide 4.14, provide justification for deviations
- Background sampling should parallel previous characterization discussions
  - Drainages, stock ponds, cattle

Section 2.0, Subsection 2.5

Background Characteristics (cont'd.)

- Soils
  - Gamma scans – provide data that demonstrates ability quantify other radionuclides
  - Subsurface soils – need characterization to demonstrate remediation in the event of a spill.
- Air particulates – need to address radon daughters

Section 3.0, Subsection 3.1

ISR/Conventional Milling Process

- Description of Mineralized Zone – place in geology
- Well Design and Construction, Integrity Tests - ISR
- Monitoring Well Network
  - ISRs: Justify No. of wells, spacing, aquifers to be monitored
  - Conv.: Monitoring network required – detection monitoring
- Methods of leak detection – place in accidents
- Propose operating plans
- Flood analysis
  - done in hydrology
  - methods to protect against flooding and erosion in this section

Section 3.0, Subsection 3.1

ISR/Conventional Milling Process (cont'd.)

- Quality Assurance programs – in Section 5.0
- Waste disposal methods and agreements
- Description of milling process:
  - Injection pressures
  - Production rates
  - Plant material balances
  - Lixiviant makeup
  - Effluents and Wastes – gaseous, liquid, solid
  - Fluid Control

Section 3.0, Subsection 3.1

ISR/Conventional Milling Process (cont'd.)

- Fluid Control:
  - Control of lixiviant migration
  - Control of impoundment fluids
  - Assessment of subsurface migration pathways – hydrology section
  - Short-term and long-term affects of ISR on water levels and flow patterns – hydrology section
  - Post-extraction affects on geochemical properties and water quality.

Section 3.0, Subsection 3.2

Facility Components

- Detailed facility layout
- Process diagrams
- Sources of emissions and wastes including discharge/release points
- Ventilation, filtration, dust collection, monitoring equipment.
- Operation parameters – flow rates, temperatures, pressures of equipment and processes

Section 3.0, Subsection 3.2

Facility Components (cont'd.)

- List of chemicals that may impact radiological safety.
- Controls for eliminating or mitigating hazards – accidents section
- Wellfield layout
  - Injection/Production
  - Monitoring well ring
  - Overlying and underlying aquifers

Section 3.0, Subsection 3.2

Facility Components (cont'd.)

- Wellfield layout (cont'd.)
- Value added analysis – modeling to demonstrate best production strategy
- Justification for monitoring well spacing
  - Calculations
  - Simple modeling
  - A recommendation in guidance or citation in another license not acceptable

Section 3.0, Subsection 3.3

Instrumentation and Controls

- Instrumentation used to monitor and control processes
- Do not need specific brands, just categories
  - Flow meters
  - Pressure transducers
  - Monitoring systems
- How will process be monitored
  - 10 CFR 40, Appendix A, Criterion 8

Section 4.0, Subsection 4.1

Gaseous and Airborne Particulates

- Monitoring for gaseous effluents and airborne particulates
- Contains information also required in Section 5.7.2 and 5.7.3. Could consolidate in one section – Operational Monitoring

Section 4.0, Subsection 4.2

Liquids and Solids

- Liquid
  - Design details for liquid management facilities
  - Deep disposal wells, 10 CFR 20.2002
  - Land application, 10 CFR 20.2002
  - Tailings impoundments
- Methods for storing and disposing of solid waste from operations
- Contingencies for system failures

Section 5.0, Subsection 5.1

Corporate Org. and Admin. Procedures

- Organizational – Detail the responsibilities in the entire organization including parent company
- Safety independence and authorization – RSO and SERP ability to raise issues.
- Identify the minimum number of SERP members. Additional members can be added w/o license amendment.

Section 5.0, Subsection 5.2

Management Control Program

- Activities in accordance with SOPs
  - Not required to submit unless relied upon to demonstrate compliance with a regulation
  - Review during inspection
- Process for preparing SOPs for routine and non-routine work
- Discusses SERP
  - Already in Section 5.1
  - Expand to include Section 5.2 information
  - Performance-based license condition must be requested.
- Safety independence and authorization – RSO and SERP ability to raise issues.

Section 5.0, Subsection 5.2

Management Control Program (cont'd.)

- Compliance with 10 CFR 20.1902(e)
  - Applicants/Licensees not automatically exempted, as stated in NUREG-1569
  - If desired, applicant/licensee must request and comply with alternative posting
- Records retention
- Reporting – Need to commit to copying NRC on any correspondence sent to state or other Federal agency regarding spills, accidents, excursions, and unusual occurrences. License Condition

Section 5.0, Subsection 5.2

Management Control Program (cont'd.)

- Some acceptance criteria written in the form of requirement. Guidance is not regulation. Need to commit to certain aspects of reporting and management and demonstrate how compliance will be met.

Section 5.0, Subsections 5.3 – 5.5

- Define the various responsibilities in management for reviews and inspections
- Specify frequency and scopes of various inspections
- Specify personnel performing inspections.
- Qualifications, Training of radiation safety personnel is consistent with Reg Guide 8.31 or explain.
- Avoid generic categories (i.e. other personnel) without discussing quals and training.

Section 5.0, Subsection 5.6

Security

- Discuss passive controls (i.e., fences)
- Active controls
- Security inspections

Section 6.0, Subsection 6.1

Plans, Schedules for Groundwater Restoration

- Detailed plans not required
- Restoration strategy required
- Estimates of volume required to restore groundwater – pore volumes, flare
  - Very important aspect of surety estimate
  - Analog Method
  - Groundwater Model – flow and transport

Section 6.0, Subsection 6.1

Groundwater Restoration (cont'd.)

- Methods, duration, chemicals, pumping strategies – incorporated into a model
- Sweep, RO, reinjection, recirculation, transfer – make sure the steps are included
- Biorestoration – NUREG/CR-6973
  - Method for assessing performance
  - Monitoring parameters

Section 6.0, Subsection 6.1

Groundwater Restoration (cont'd.)

- Monitoring network
  - Propose number and locations of wells for monitoring restoration, different from operational monitoring network.
- Parameters to be included in restoration monitoring
- Frequency of Monitoring

Section 6.0, Subsection 6.1

Groundwater Restoration (cont'd.)

- Restoration standards
  - 10 CFR 40, Appendix A, Criterion 5(B)(5).
  - Baseline, Table 5C, alternate concentration limits (ACLs).
  - If parameter is not listed on Table 5C, can use MCL, but it's still officially an ACL.
  - Class of use is not a secondary standard, could be used as a basis for an ACL.
  - NUREG-1620, has procedure for preparing an application for an ACL

Section 6.0, Subsection 6.1

Groundwater Restoration (cont'd.)

- Restoration standards
  - Need to propose baseline computation method
  - Restoration standards defined as baseline water quality in production zone
- Post restoration stability
  - 4 quarters of groundwater sampling
  - Need to address hotspots

Section 6.0, Subsection 6.1

Groundwater Restoration (cont'd.)

- Hotspots
  - At this point, considered 2 standard deviations above mean
  - Analysis to determine that offsite groundwater quality will not be affected
  - Future guidance on hotspots to be provided in the revised NUREG-1569

Section 6.0, Subsection 6.1

Groundwater Restoration (cont'd.)

- Well abandonment – usually the state procedures
- An assessment of drawdown in wells offsite – consumptive use of production and restoration
- Liquid waste – addressed in Section 4.2

Section 6.0, Subsection 6.2

Reclamation Plans

- Final Reclamation/Decomm Plan due 12 months before commencement of reclamation and decomm
- Reclamation and decomm strategy - in application
- Need to provide method for estimating contaminated soil volumes for surety estimate
- Discussion of pre and post reclamation survey strategies – discussed in Section 6.4
- Decomm/reclamation covers non-rad constituents

Section 6.0, Subsection 6.3

Waste Removal and Disposal

- Program for controlling radioactivity on structures or equipment
- Release criteria – need to account for radium in some cases
- Information from this section can be lumped into Section 6.2

Section 6.0, Subsection 6.3

Waste Removal and Disposal

- Commits to submitting decommissioning plan 12 months before commencement
- Methodologies need to be provided in application
- Program for controlling radioactivity on structures or equipment
- Release criteria
- Some or all of this information could be lumped into other sections.

Section 6.0, Subsection 6.5

Financial Assurance

- Needs to incorporate the complete range of restoration/reclamation/decomm activities
- Need to have a basis for costs.
  - Contractor estimates
  - Can be kept non-public, if requested
- Guidance – Appendix C of NUREG-1569, NUREG-1757
- Various commitments – License conditions

Section 7.0

Accidents

- Need to state how applicant will prevent, mitigate, and remediate accidents
- NUREG/CR-6733
  - Provides accident scenarios
  - Uses U3O8 form of yellowcake
  - Need to acknowledge that 6733 is conservative and state reason.
  - If Class D is present, need to analyze for kidney effects

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5.7 Radiation Safety Controls & Monitoring

5.7.1 Effluent Control Techniques

- Provide data on performance specifications of all effluent control equipment.
  - Vacuum dryers
  - Ventilation (general (e.g., area) and specific (e.g., yellowcake packaging))

- Provide test and inspection schedules and inspections items of all effluent control equipment.
  - Compare to manufacturer's recommendations.

5.7.1 Effluent Control Techniques

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- Provide drawings depicting effluent release points.
  - Yellowcake dryers.
  - Ventilation
  - Could be combined with 3.2
- Address emergency procedures.
  - Equipment failures
  - Power outages

5.7.1 Effluent Control Techniques

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10 CFR 40, Appendix A, Criterion 8:

- Identify parameters that determine efficiency of yellowcake stack emission control.

5.7.1 Effluent Control Techniques

10 CFR 40, Appendix A, Criterion 8, cont'd

- If automated systems are used to satisfy the checking and logging requirements:
  1. Demonstrate compliance with hourly requirement.
  2. Identify types and locations of human interface (alarms, lights, monitoring stations, etc.).
  3. Provide details on how and what frequency the operability of emission control system (not just the alarms, lights, etc.) is tested and recorded.
  4. In the case of inoperability, provide details on how shutdown is initiated (manually or automatically).

5.7.2 External Radiation Exposure Monitoring Program

- Provide criteria for establishing which employees receive external exposure monitoring.
  - Consistent with Regulatory Guide 8.34, *Monitoring Criteria and Methods to Calculate Occupational Radiation Doses.*
  - It is better to start with more employees in the program and use data to reduce the number of monitored employees if desired.

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- Discuss expected external exposure rates throughout the plant and wellfield.
- Provide information on radiation monitoring equipment, including personal dosimetry.
  - Type
  - Sensitivity
  - Calibration method, frequency

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- Should have detection capabilities of at least 100 mrem/hr.
- Beta detection and personnel monitoring for beta exposure should be addressed.

5.7.3 Airborne Radiation Monitoring Program

- Describe proposed sampling program to determine concentrations of airborne radioactive materials.
  - Address routine and non-routine operations, maintenance, and cleanup activities.
  - Particulates and radon.
  - Provide criteria for determining sampling locations with respect to process operations and personnel occupancy.

5.7.3 Airborne Radiation Monitoring Program

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Program Description, cont'd

- Provide drawing with facility layout and sampling locations.
- Regulatory Guide 8.25, *Air Sampling in the Workplace*

- 10 CFR 20.1501 requires surveys to evaluate potential radiological hazards.
  - Must evaluate uranium daughters including beta-gamma emitters.
  - Gross alpha not appropriate until a complete characterization of operations performed and verified at proposed frequency.

5.7.3 Airborne Radiation Monitoring Program

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- Evaluate respiratory protection.
  - Regulatory Guide 8.15
- Program addresses 10 CFR 20.1201(e) limits for soluble uranium.
- Provide information on monitoring equipment.
  - Type
  - Sensitivity
  - Calibration method, frequency

5.7.3 Airborne Radiation Monitoring Program

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- LLD for uranium will depend on the inhalation classification.
- Address 10 CFR 20, Subpart L record keeping requirements.
- Address 10 CFR 20, Subpart M reporting requirements.

5.7.4 Exposure Calculations

- Proposed methodology for calculating internal exposures should be based on ICRP-30.
  - Consistent with Regulatory Guide 8.34
  - May request exemption to use more current dosimetry models. Will need to provide detailed analysis of program.
- Compliance with 10 CFR 20.1204
  - Specifies how to analyze mixtures of radionuclides in air.

5.7.4 Exposure Calculations

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- Provide clear specifics on how exposure times will be calculated and used.
- Provide justification for proposed uranium inhalation classification.
- Provide program details on evaluating prenatal and fetal radiation exposure.
  - Regulatory Guide 8.13
  - Regulatory Guide 8.36

5.7.4 Exposure Calculations

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- Need to evaluate radon exposure in the wellfield in addition to the main processing plant and satellite facilities.
  - This exposure counts as occupational exposure for workers.
- Reporting and record keeping of worker doses consistent with Regulatory Guide 8.7.

5.7.5 Bioassay Program

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- Program is consistent with Regulatory Guides 8.9, 8.22 (Bioassays) and 8.31 (ALARA).
  - Number and category of personnel in program.
  - Types and frequencies of bioassays performed.
  - Action level criteria applied to results

    (NOTE: Action levels in RG 8.22 are based on monthly results).

5.7.6 Contamination Control Program

- Provide details of personnel survey requirements.
  - Provide actions if contamination above limits found.
  - Provide details on survey instrument capabilities (scan MDC, etc.).
  - Program should evaluate uranium daughters, including beta-gamma emitters.

5.7.6 Contamination Control Program

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- Proposed action levels for surface contamination consistent with Enclosure 2 of Policy and Guidance Directive FC 83-23 dated November 4, 1983, as updated.
  - Reasonable effort to eliminate residual contamination.
  - Address Interior surfaces of pipes, drain lines, or ductwork.
  - Address inaccessible surfaces.

5.7.6 Contamination Control Program

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- Provide details of action levels for restricted areas and clean areas.
- Provide details of survey equipment.
  - Type
  - Sensitivity
  - Calibration frequency
- Provide details on personnel performing surveys.
  - Regulatory Guide 8.31 provides recommendations regarding which personnel should perform surveys.

5.7.7 Airborne Effluent and Environmental Monitoring Program

- These programs have been treated as the same, but are two separate and distinct programs with different purposes.
- Regulatory Guide 4.14 is currently under revision.
  - Comments and suggestions welcome. Send to James.Webb@nrc.gov.

5.7.7 Airborne Effluent Monitoring Program

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- Airborne effluent monitoring programs should address the following areas:
  - Provide data to analyze maximum public exposure in accordance with 10 CFR 20.1301/1302 (e.g., anywhere within the Permit Area).
  - Provide data to report effluents in accordance with 10 CFR 40.65 (i.e., at the boundary of unrestricted areas).
  - Occupational dose due to airborne effluents should be analyzed outside of plant areas.

5.7.7 Airborne Effluent Monitoring Program

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- Effluent monitoring programs should evaluate both point (e.g., a defined stack or pipe) and diffuse (e.g., loose surface contamination escaping the central processing plant) sources.

5.7.7 Airborne Effluent Monitoring Program

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- Calculations are allowed to demonstrate compliance with 10 CFR 20.1301/1302.
- NRC staff expects that licensees will perform effluent monitoring consistent with guidance and to such an extent as to be able to:
  1. Confirm the licensing basis, and
  2. Confirm the validity of calculations used for estimating effluent concentrations and calculating dose.

5.7.7 Environmental Monitoring Program

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- Environmental monitoring program should be based on information from other parts of the application, including the Environmental Report.
  - Site description (e.g., drainages, nearby stock ponds)
  - Meteorological data (e.g., primary wind direction)
  - Land use (e.g., cattle, crops, etc.)

5.7.7 Environmental Monitoring Program

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- If proposing a monitoring program different from Regulatory Guide 4.14 (location, frequency, isotopic analysis, etc.), provide detailed justification.
- Applicants for ISRs w/o dryers need to address radon daughters, pregnant lixiviant field spills, and transportation accidents when developing operational monitoring programs.

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Questions?

6.4 Post Reclamation and Decommissioning Radiological Surveys

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- Provide discussion on soil cleanup program.
  - Areas to be surveyed.
  - Details on pre-reclamation surveys, including how baseline surveys will be used to identify potentially contaminated areas.
  - How final radiological soil conditions after cleanup will be measured and documented.

6.4 Post Reclamation and Decommissioning Radiological Surveys

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- Address all aspects of 10 CFR 40, Appendix A, Criterion 6(6).
  - Radionuclides other than radium (radium benchmark dose).
  - Address subsurface contamination.
- Address nonradiological hazardous constituents as required by 10 CFR 40, Appendix A, Criterion 6(7).