

## Dar Al Riyadh Insight #105 Elements of O&MBOD

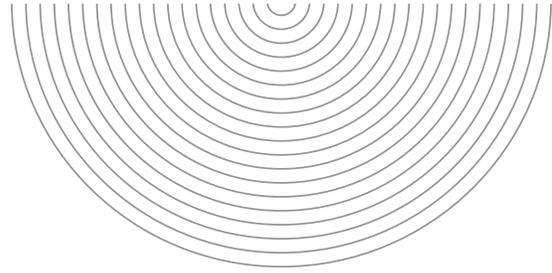
*Dar Al Riyadh Insights reflect the knowledge and experience of our Board, executives and staff in leading and providing PMC, design and construction management services. Dar Al Riyadh believes in the importance of broadly sharing knowledge with our clients and staff to improve project outcomes for the benefit of the Kingdom of Saudi Arabia.*

### Elements of O&MBOD

Operating and maintenance costs often represent over half of the life-cycle costs of a capital asset on a present-worth basis.

Development of an effective O&M basis of design should, as a minimum, encompass:

- Comprehensive identification of required or preferred construction strategies, tactics, techniques, and tools to be incorporated in the O&M process, which influences design.
- O&M labor, skills, equipment, materials (including consumables), and temporary provisions for maintenance are to be reflected in the basis of design.
- O&MBOD addresses unique requirements to be incorporated in design development that reflects owner or contractor preferences for achieving the owner's project requirements (OPR). These requirements may reflect:
  - Prior experience of the owner.
  - Unique constraints associated with the project location; environmental setting; process operations; and labor availability, cost, and skill level.
  - Contracting community capabilities and experience.
  - Special tools required for major maintenance.



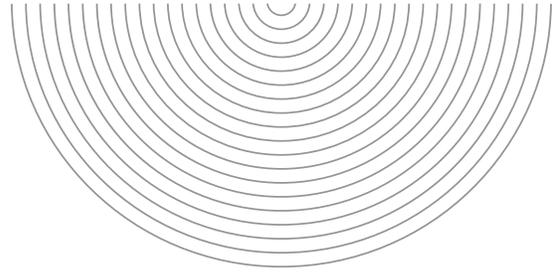
- Broader programmatic objectives required of the owner or independently committed to by the owner that influence maintenance execution.
- The applicable safety program to be used during facility operation.

O&MBOD considerations may be broadly grouped as basis of design requirements related to:

- Labor
- Equipment
- Materials
- O&M practices and techniques
- Management processes and practices

#### Labor

- Sourcing
  - Provisions required to address union work rules
  - Provisions required to meet workforce cultural or local practices requirements
    - Example: prayer rooms; special food preparation requirements; gender segregation
- Safety
  - Hazard elimination
    - Identify changed safety conditions associated with maintenance activities and eliminate or mitigate new safety hazards
    - Access points and covers should not have sharp corners
    - Design should reflect safe access for maintenance and repair
    - Avoid hazardous access points (manholes in live traffic areas)
    - Reduce weight of components frequently moved (manhole cover; access plate; paving slabs; concrete curbs)
    - Provide for “isolation” of equipment to maintenance under continuous operations:
      1. Lockout valves and switches

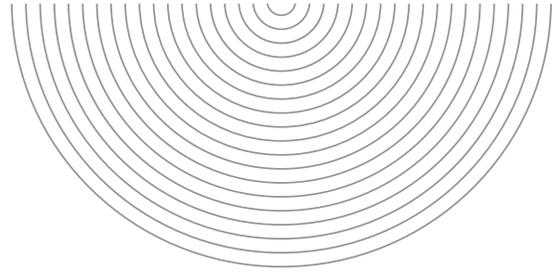


## 2. Electrical isolation

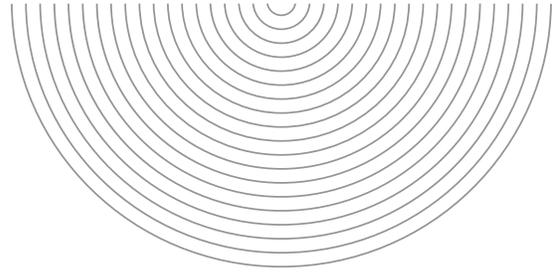
- Hazard mitigation
  - Reduce the hazard
    1. Minimize work at height.
    2. Minimize hand operations during maintenance.
    3. Minimize potential pinch points.
    4. Minimize sharp corners.
    5. Minimize exposure time in extreme environments associated with periodic maintenance.
    6. Minimize need for lifts or temporary ladders for routine maintenance.
  - Improved access to workface
    1. Required work platforms and equipment laydown or pull areas to be reflected in design
    2. Space provisions for temporary equipment required for maintenance operations and accessibility envelope
- Knowledge
  - Ensure full engineering, procurement, construction data pull through to asset management and O&M systems.
- Productivity
  - Facilitate grouping or simultaneous performance of maintenance operations.

### Equipment

- Maintenance
  - Incorporate maintenance provisions in design development.
    - Reflect maintenance set-up and staging requirements.
    - Identify typical *combinations* of maintenance activities in plant and systems design and layout.
    - Design for rapid replacement of routine maintenance items (plug and play; quick opening fasteners).



- Systems/subsystems/components should be designed to be functionally, mechanically, electrically, and electronically as independent as practical to facilitate maintenance and testing.
- Maintenance “envelopes” should be reflected in design layouts.
- Increase accessibility to areas of frequent maintenance.
  - Provide flat laydown areas for components removed during maintenance or replacement
  - Identify provisions for maintenance (scaffolding, lifts etc.)
  - Identify any maintenance crane or other temporary equipment support points and confirm capacity and clearances
- Minimize joints and bearings.
- Incorporate temporary maintenance provisions in base design to avoid use of temporary hoses, power lines, and so forth.
  - Power
  - Water
  - Compressed gases
  - Wastewater including spill collection
  - Attachment points (for lifting equipment for access removal or repair or replacement)
  - Attachment points for temporary crane rails or mobile equipment envelopes
- Repair
  - Reduce spare parts requirements, costs, and risks through design.
    - Minimize spare part types.
    - Identify long lead items for spares planning.
    - Ensure long-term availability for spares.
    - Standardize components to minimize maintenance spares and tool sets.
- Replacement



- All machines fail at some point and must be repaired or replaced.

Provide for this activity.

- Consider replacement strategies for major components over the project's full lifetime.

### Materials

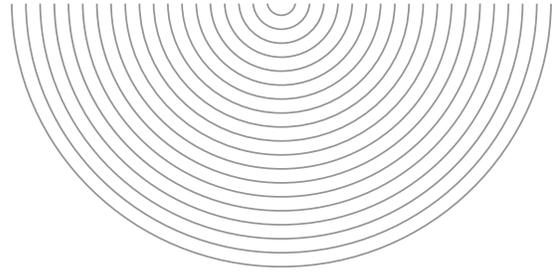
- Minimize maintenance to the extent achievable
  - Improve deterioration and environmental resistance of exposed systems and structures (mildew; organic pollutants).
    - Moisture – eliminate ponding especially on exposed steel surfaces; ensure good drainage.
    - Caustic materials including materials associated with cleaning and maintenance
    - UV light
  - Minimize need for painting.
  - Minimize surface and material wear.
    - Identify potential areas susceptible to corrosion abrasion.

### O&M practices and techniques

- Unique O&M practices or techniques to be utilized and provided for in design:

### Management Processes and Practices

- Build O&M documentation from initiation of design.
  - Failure Mode and Effect Analysis (FMEA) and Fault Tree Analysis (FTA) should be included in system and component maintenance documentation.
  - Identify all maintenance assumptions and requirements in design documents and consolidate and **track**.
- O&M information, including equipment and vendor data, should be required to be directly incorporated in the facility asset model (building information model (BIM)) or database.
- Contractual provisions to support long-term O&M.



- Special warranty or servicing requirements
- Performance contracting requirements