

Reduce Your RCM Resource Needs

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Overview

RCM Has Limitations

Reality Check

Nuclear Power Solution

Dynamic Database Solution

Recent Oil and Gas Example

Conclusion: Value to the Client!

RCM Has Limitations

RCM - Gold Standard!

Takes a long time

Teamwork

Diverts from regular duties

Hard to sustain over the long haul



RCM Has Limitations

- **Original Boeing/United Airlines effort was cost-effective for a fleet**
- **Some dedicated in-house efforts have been successful (e.g. Shell)**
- **US Nuclear Power Plants found RCM was not cost-effective on a large scale**
- **Most RCM programs stall out after the first flash of success**

RCM Has Limitations

- **Not usually enough standardization for one RCM solution to apply unchanged to other applications**
- **Sometimes, this works**
 - **Boeing successfully applied RCM to many identical production machines**
 - **Other manufacturing facilities have done, or could do the same (steel mills, paper mills)**

RCM Has Limitations

- **Requirements for 'fleet application' are basically:**
 - **Same hardware, same duty cycle**
 - **Same environment**
- **RCM can also be successful when focused on a few troublesome systems**
 - **But this ignores the rest of the plant, which also needs a maintenance program**

Reality Check

- **Plants have equipment of a given type, that is not identical, but shares most design features**
- **However, operating environments and duty cycles can vary widely**
- **Opportunity!**

Reality Check

- **How much do we care if methodology departs from standard RCM – e.g. JA1011?**
 - **Depends on type and extent of departure**
- **Are all 'valid' RCM approaches the same?**
No!
- **Is there reason to suspect that RCM may not be perfect? – Yes!**

Reality Check

- **Is there reason to suspect that RCM is the only good way to plan PM? No!**
 - **It may be the best in principal, but if you can not afford to do it, or you can do it only here and there.....**

Reality Check

- **Do I think the 7 steps in JA1011 are important for a good PM solution?**
 - **Yes, but the steps need interpretation**
 - **They should demand respect, but not reverence**
 - **Do not let the perfect be the enemy of the good!**

The Nuclear Power Solution

- **Nuclear power plants experimented with RCM during 1982-95 and found practical limits**
 - **Takes too much team time – whole team not needed at every step**
 - **RCM functional analysis too time consuming for benefit gained**
 - **Needs 'Task Consolidation'**
 - **Team knowledge is often limited, e.g.**
 - **Time scales of degradation often not known**

The Nuclear Power Solution

- They replaced RCM functional analysis
 - Developed important plant level effects–
Criticality Check List
 - Operators assigned Check List to
equipment failures
 - Implicitly at level of equipment failure
modes
 - Not at level of degraded conditions

The Nuclear Power Solution

- **This worked fairly well because**
 - **Most equipment was standard with well known failure modes**
 - **Operators were very well trained**
 - **Power plant responses to single failures were well known**
 - **Practical PM Tasks were well known and already 'packaged'**

The Nuclear Power Solution

- **Still needing improvement**
 - **Equipment degraded conditions not at a very detailed level**
 - **PM Task content was mapped to the degraded conditions but therefore not comprehensive**
 - **Not much guidance on what to look at and what you are looking for**
 - **This is also often true of RCM**
 - **Task *intervals* lacked strong technical basis**

Dynamic Database Solution

- **EPRI developed a PM Basis database, used by 84% of US nuclear plants**
 - **Detailed degraded conditions from equipment experts (187 equipment types) capture industry experience**
 - **Best Practice embodied in PM recommendations**
 - **Users adjust service stressors to prioritize the most likely failure mechanisms**
 - **Incorporates mild to severe applications**

Dynamic Database Solution

- **Goes beyond RCM**
 - **Degraded conditions are 10 times more detailed**
 - **PM Task content is comprehensive**
 - **Provides good guidance on what to look at and what you are looking for**
 - **Usually exceeds what RCM provides**
 - **Strong technical basis for Task Intervals**
 - **Task maps to degraded states are quantitative**
 - **PRO-M version of the database ranks tasks by benefit to cost ratio**

Recent Oil and Gas Example

- **Application of PRO-M to a large bitumen upgrading facility**
 - **Retained the RCM functional analysis but at level of implicit equipment failure modes**
 - **Also used the Criticality Check List (fast) for early focus on the most important equipment**
 - **Little need to edit generic equipment FMEA's despite new O&G application**
 - **Omitted FMEA for simple components, e.g. filters, strainers, space heaters, etc.**

Recent Oil and Gas Example

- **Scope included ~30 systems**
 - **Excluded passive equipment, I&C, valves**
 - **656 equipments: mostly rotating, e.g. turbines, motors, compressors, pumps, fin fans, FD/ID fans, gearboxes, all lubrication and seal oil, some heat exchangers**
 - **Integrated RCM results with risk**
 - **Frequency, consequence, and risk rank for each plant level effect in the functional analysis**

Conclusion: Value to the Client!

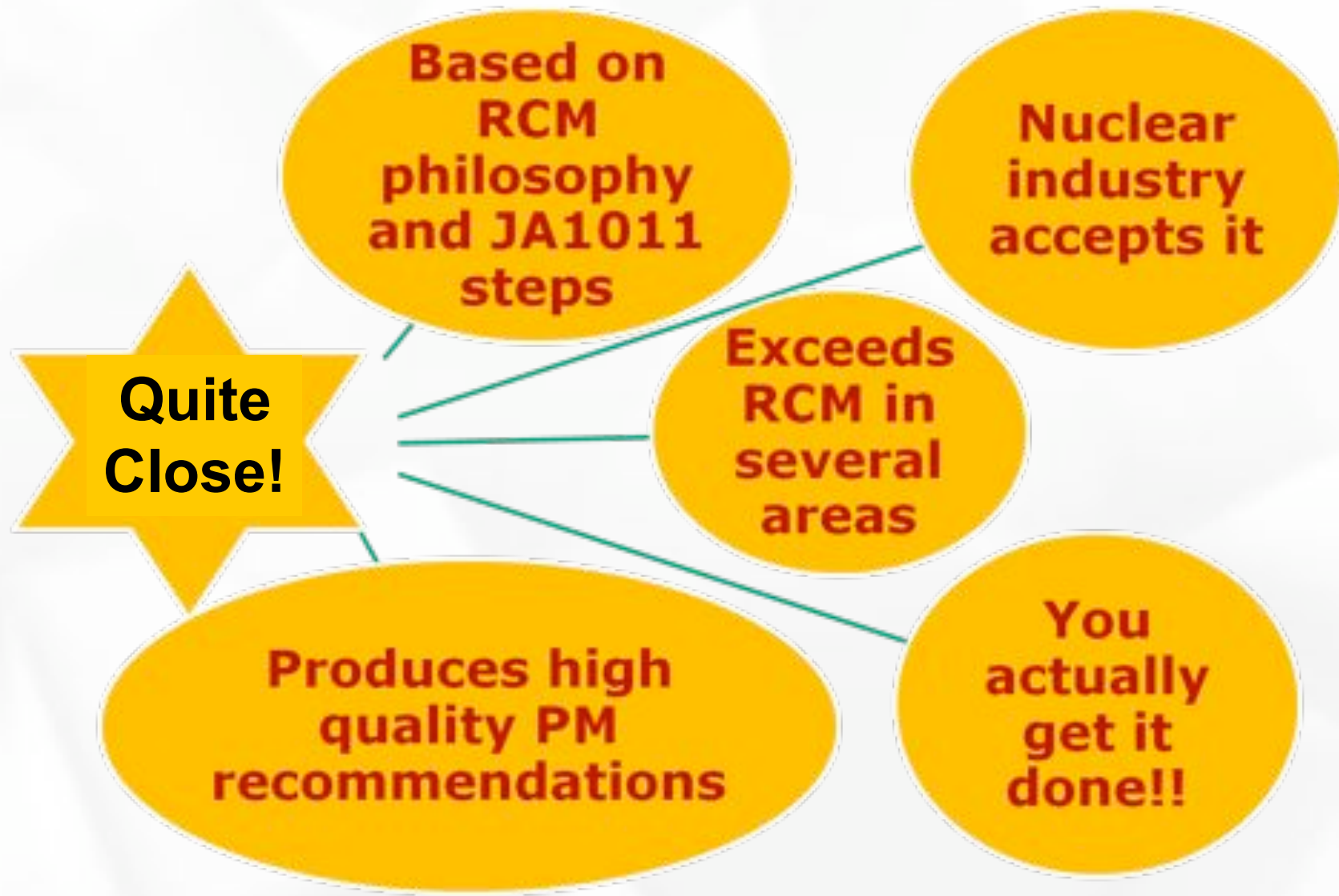
- **Remarkably, only 4 hours per week from each of two plant teams were needed over 25 weeks**
 - **Less than 10% of that needed for conventional RCM**
 - **Much of that spent on functional analysis**
- **Analyzed 2405 plant level effects, developed 3097 PM tasks with task content, and risk ranking**
 - **Results were well received**

Conclusion: Value to the Client!

**Much lower demand
on plant personnel**

***RCM's basic
limitation is
effectively removed!***

Is This Still RCM?



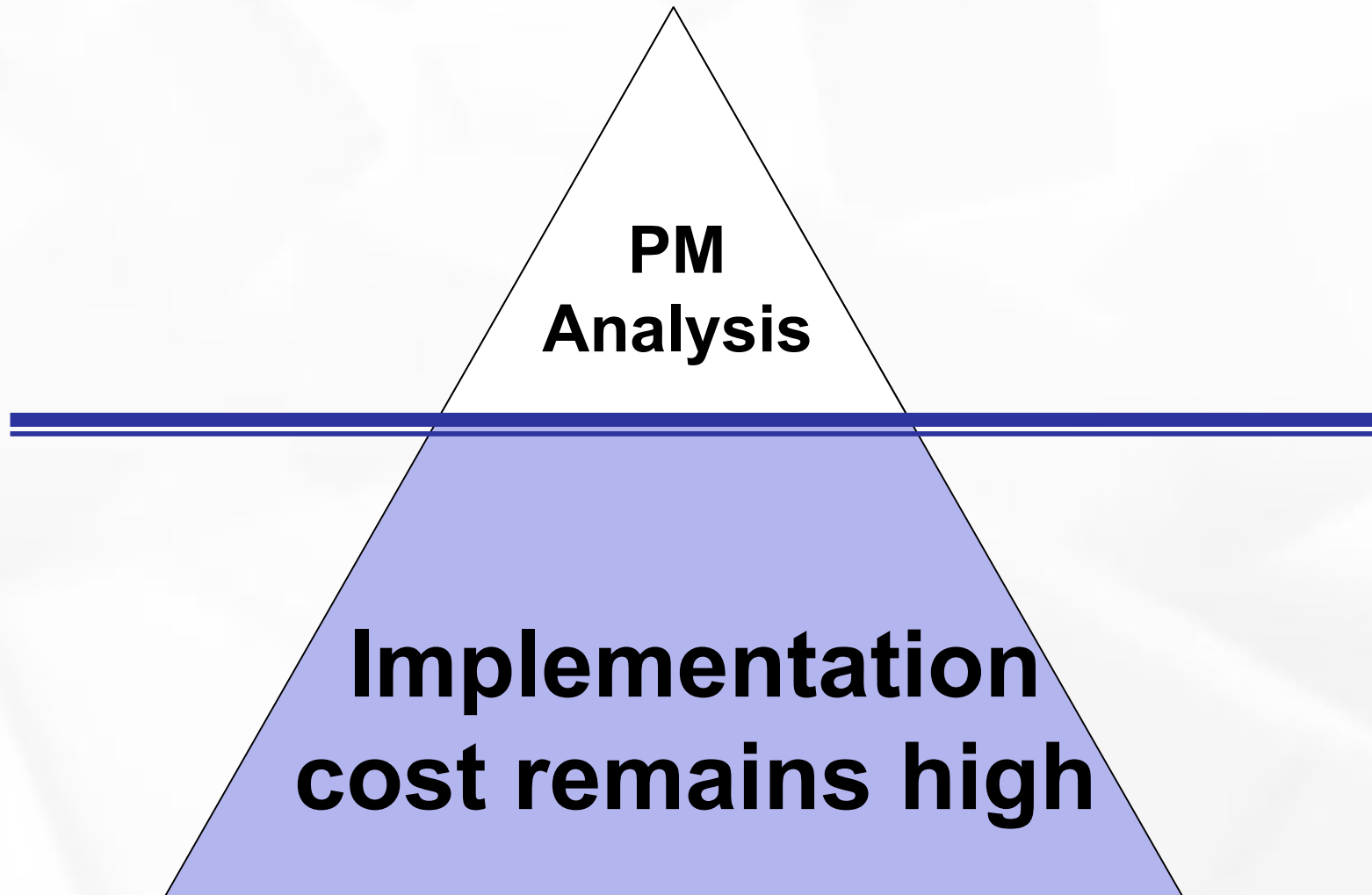
Less Demand on Plant Personnel

**Sustainable
over the
long term**

**Much more
of the plant
can be
optimized**

***Comprehensive
PM optimization
at lower cost***

Caution!



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