反渗透海水淡化厂主要危害的风险评估与控制

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摘 要：由于人力是任何工业工厂或组织中最宝贵和最重要的生产要素，因此必须管理他们的健康和安全，以保护他们免受合理可预见的风险。本文对 5 个反渗透脱盐厂进行了风险评估，以发现这类厂的主要危害。健康安全执行-五步风险评估模型，包括 5×5 风险矩阵，对风险等级进行排序，然后用彩色代码表示，明确优先级。在评估风险和监测和分析工作活动时，考虑到作业中包括的材料、设备、工作场所和人员。最常见的危险是在高空工作、在密闭空间或水下工作、接触噪音、接触未盖的旋转设备、电力、高压流体和火灾。我们已采取控制措施，将已识别的危险程度减低至可接受的水平，例如制定工作许可证制度和进入密闭空间或在水下工作的程序，在处理电气设备时将电源锁上并贴上标签，保护机器的所有旋转部件，为高空工作提供合适的设备，减少接触噪音的时间，以及提供足够的培训，给员工的信息和安全说明。本文可作为反渗透海水淡化厂操作人员的安全手册。

关键词：风险评估；危害识别；职业健康与安全；反渗透；海水淡化厂；危害控制措施

Risk Assessment and Control for Main Hazards in Reverse Osmosis Desalination Plants

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Abstract: As the manpower is the most valuable and important element for production in any industrial plant or organisation, so their health and safety must be managed to protect them against the reasonably foreseeable risks. In this paper risk assessment is carried out for five Reverse Osmosis desalination plants to detect the main hazards in such type of plants. Health safety executive -five steps to risk assessment model is used including 5 × 5 risk matrix to rank the risk level and then represented by color code to clarify the priority. The materials, equipment, working place and peoples included in the operation are considered while assessing the risk and working activities are monitored and analyzed. The most common hazards are found in working at height, working inside confined spaces or under water, exposure to noise, contacting with uncovered rotating equipment, electricity, high pressurized fluid and fire. The control measures are introduced to mitigate the level of identified risks to an acceptable level like developing a permit to work system and procedures for confined space entry or working under water, lock out and tag out of the power supply while dealing with electrical equipment, guarding all rotating parts of the machines, provide the right equipment for working at height, reduce the exposure time to noise and providing sufficient training, information and safety instructions to the employees. This paper can be used as a safety booklet for RO desalination plants operators.

Keywords: Risk assessment; Hazard identification; Occupational health and safety; Reverse osmosis; Desalination plants; Hazards control measures

1.引言

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Severity / likelihood	In significant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Very likely (5)	5	10	15	20	25
Likely (4)	4	8	12	16	20
Fairly likely (3)	3	6	9	12	15
Unlikely (2)	2	4	6	8	10
Very unlikely (1)	1	2	3	4	5

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Severity likelihood	In significant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Very likely (5)	5	10	15	20	25
Likely (4)	4	8	12	16	20
Fairly likely (3)	3	6	9	12	15
Unlikely (2)	2	4	6	8	10
Very unlikely (1)	1	2	3	4	5

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Risk level	Action
20 – 25	Stop – stop the activity till immediate action is taken to control and reduce the risk
15 – 16	Urgent action – take immediate and rigorous action without stopping the activity if practicable
8 – 12	Action – take suitable action within specified time scale to improve the existing control to reduce the risk level
3 – 6	Monitor – continuously monitor the existing control measures to ensure it still effective and improve if required
1 - 2	No action – no further action is needed but the assessment should be reviewed periodically

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3.反渗透海水淡化厂相关危险的风险评估

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Severity likelihood	In significant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Very likely (5)	5	10	15	20	25
Likely (4)	4	8	12	16	20
Fairly likely (3)	3	6	9	12	Before(15)
Unlikely (2)	2	After (4)	6	8	10
Very unlikely (1)	1	2	3	4	5

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Severity / likelihood	In significant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Very likely (5)	5	10	15	20	25
Likely (4)	4	8	12	16	20
Fairly likely (3)	3	6	9	12	15
Unlikely (2)	2	4	6	8	Before(10)
Very unlikely (1)	1	After (2)	3	4	5

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Sound Level dB(A)	Exposure Equivalent to 85 dB(A) $L_{EP,d}$
85	8 hours
88	4 hours
91	2 hours
94	1 hour
97	30 mins
100	15 mins
103	7.5 mins

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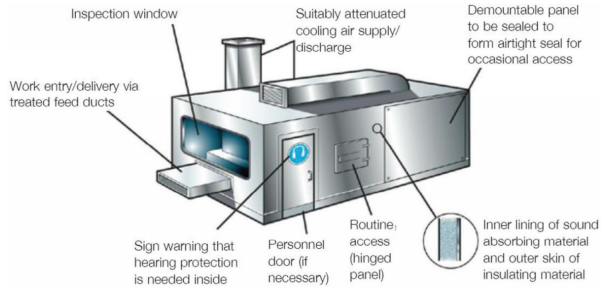

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Severity / likelihood	In significant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Very likely (5)	5	10	15	20	25
Likely (4)	4	8	12	16	20
Fairly likely (3)	3	6	9	Before (12)	15
Unlikely (2)	2	After (4)	6	8	10
Very unlikely (1)	1	2	3	4	5

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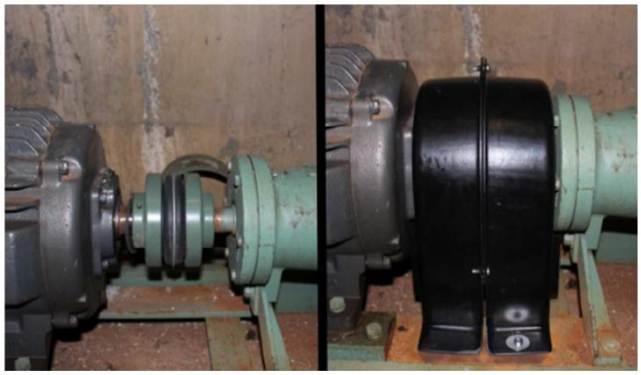

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Severity likelihood	In significant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Very likely (5)	5	10	15	20	25
Likely (4)	4	8	12	Before (16)	20
Fairly likely (3)	3	6	9	12	15
Unlikely (2)	2	4	6	8	10
Very unlikely (1)	1	2	3	After (4)	5

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Severity likelihood	In significant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Very likely (5)	5	10	15	20	25
Likely (4)	4	8	12	16	Before (20)
Fairly likely (3)	3	6	9	12	15
Unlikely (2)	2	4	After (6)	8	10
Very unlikely (1)	1	2	3	4	5

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Severity likelihood	In significant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Very likely (5)	5	10	15	20	25
Likely (4)	4	8	12	16	20
Fairly likely (3)	3	6	9	12	Before (15)
Unlikely (2)	2	4	6	8	10
Very unlikely (1)	1	2	3	4	After (5)

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Severity likelihood	In significant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Very likely (5)	5	10	15	20	25
Likely (4)	4	8	12	16	20
Fairly likely (3)	3	6	9	12	15
Unlikely (2)	2	4	6	8	Before (10)
Very unlikely (1)	1	2	3	After (4)	5

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4.结论

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