



# Monitoring Strategy of Chrome Electroplating Workers' Health at Company XYZ

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## **Authors' contributions**

*All authors have a significant contribution in this paper; both of data collection, data analysis and discussion. All authors read and approved the final manuscript.*

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## **ABSTRACT**

Consequently, one million deaths from 14% of fatality due to occupational accidents caused harmful substances in the year 2015; therefore, it increases of more than 90000 workers when compared to 2011. Company XYZ with workers about 2500 people is a company that provides special electroplating (chrome plating) service to repair vessels within industry.

This study aims to recommend a strong policy that can be applied to monitor chrome plating workers' health in Company XYZ. The method used in this study is a qualitative approach with analysis methods, strategic assumption surfacing and testing (SAST) and to obtain decisions about recommendations to be taken using the exponential comparison method (ECM). The results shows that the level of exposure of chromium on workers in company XYZ was at high risk level, which may affected worker' health, 2 of 13 workers have a rate of chromium in blood 1.11ug/L and 1.10ug/L. Therefore the expert recommendation of the medical surveillance program for this research study; that all workers are required to do periodic medical assessment every 6 months, and the medical assessment for worker prior joining in the chrome plating project is must. In addition, focused medical assessment will include complete blood count, liver function, renal function, chromium serum in blood and urine, spirometry, chest x-ray, integument and respiratory

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system. Deep interview on medical and occupational history, such as the presence of chromium exposure in the past, current and anticipated future exposures are also required to support the data for evaluation purpose. The ability to use respirators assessment considers as additional assessment to protect the workers accordingly. The health practitioner will summarize all medical reports, discuss and provide recommendation to employee as well as to the employer.

*Keywords: Chromium; Strategic Assumption Surfacing and Testing (SAST); Exponential Comparison Method (ECM).*

## 1. BACKGROUND

In this decade, occupational health and safety nowadays as the main key that everyone responsibility and it as the indicators of worker welfare. Refer to the data of accidents and fatality at the workplace, it still shows high and this is a dilemma for all countries. Work-related accidents has place at rank fourth in the world cause of death (14%) of all causes of loss in 2015. Nearly one of million deaths is due to work accidents caused by hazardous substances, therefore, it increases of more than 90000 workers compared to 2011[1].

Company XYZ is one of the leading shipyard companies in the Middle East offering a comprehensive range of marine services as well as solutions for the oil and gas industry. The existence of Company XYZ symbolizes the world-class facilities that have been developed jointly by the Industrial City. The said company has workers around 2500 people and therefore one of its company service activities now is an electroplating service (chrome plating) to repair liquefied natural gases (LNG) vessels as well as tugboats.

Electroplating is a process of precipitation of substances (metal ions) on a base metal (cathode) through the process of electron. Generally, plating aims to protect from corrosion, enhance the appearance of metallic surface and improve the mechanical properties of a metal mechanical. Chrome plating includes many processes with different exposure, which can cause adverse effects to workers' health.

Chromium can enter into the body through breathing (inhalation) and through direct skin contact [2]. Exposure to chromium has been shown to cause very serious health effects. The accumulation of vapor inhaled during the process of chromium plating can cause shortness of breath and lead to lung cancer. Other serious health effects from chromium exposure will cause skin rash, skin irritation or ulcers or even ulceration (ulcers), ulceration of the nasal

mucous membranes, vascular effect (blood vessels in the aorta), anemia and cause the body lethargic, lowers body immunity, reproductive disorders and kidney disorders. The result of chromium exposure can also cause cancer.

Research strategy monitoring of health screening of chrome plating workers at Company XYZ aims to form the recommendations that can be applied to monitor the health of chrome plating workers in Company XYZ. To achieve the objective of the study will be briefly describe the health condition of chrome plating workers in Company XYZ and design the concept of a medical surveillance program as a reference for workers' health monitoring in the industry.

## 2. LITERATURE REVIEW

The electroplating process is carried out by the electrochemical principle using anode and cathode [3]. Anode is a metal used to coat other objects; in this case chrome is used as an anode. The cathode is an object that will be coated, which can be steel, plastic, etc. Anode is associated with the positive pole of the power source, while the cathode is connected to a negative power source. Anode and cathode are equally incorporated into a container filled with an electrolyte fluid that serves to conduct electricity.

Chromium metal is used in the final stage of the electroplating process, used to enhance the physical and mechanical properties of the coated objects. In addition, in accordance with its nature, chromium metal is beneficial to make an object to be corrosion resistant and also beautify its appearance to be loud and shiny. The heavy metals of chromium (Cr) are metal in gray, resistant to oxidation at high temperatures, shiny, hard, paramagnetic, colorless, and polished to be shiny. Chromium is a natural element found in rocks (chrome ores), animals, plants, soils and volcanic dust. Chromium in the environment in the form of Chrome (CR 0), chromium (III), and chromium VI). Chromium (III) is naturally present in nature, is a micronutrient for living

beings in the metabolism of insulin hormones and the setting of blood glucose levels. Disadvantages of chromium (III) cause Chromium Deficiency. But in high doses will be toxic [4]. While hexavalent chromium is obtained through heating on the alkali PH and used as a source of chromium for industrial purposes. The criteria of the World Health Organization stated that the normal levels of chromium in the blood range from 0.5 µg/L. As for maximum urine with range from 11 µg/L later to hair and nail levels of chromium are allowed around 50-1000 ppm [5].

Medical check-up (MCU) of employees is a health screening conducted against employees or prospective employees in a working environment. This medical examination aims to identify and early detect health disorders that employees may experience due to certain factors in the work environment.

Here are the objectives of the implementation of health screening:

- To perform early detection of worker health. Do not arrive later when workers' health is less than good and will affect new workplace productivity.
- Moreover, if the worker suffers from infectious diseases and of course this potentially has another colleague. So it is important to implement the MCU for the process of preventive spreading infectious diseases. Not only infectious diseases, but also other diseases that can harm themselves or other employees.
- By knowing the health condition in advance, it can prevent or delay the occurrence of complications of disease.
- For the company, with the implementation of MCU is expected to reduce the company costs in terms of health. Conceivably, if any employee is sick, there will be a vacancy in the work in this regard. By this way, the company must issue additional fees to pay health claim costs, or to find other candidates or overtime fees for other employees to replace the sick employee's work.
- Employees are pleased with companies that care about the health of their employees as with the implementation of MCU. Employees will also become more loyal to the company.

Health screening is divided into 3 categories [6]:

### 1) Health screening before work

The employer is required to perform a medical examination for their employee before start the work to ensure employees' health and free from an infectious disease that potentially transmit the illness to other workers.

### 2) Periodic health screening

This periodic health screening or annual MCU where the examination of this period is intended to maintain the worker' health (generally implemented once a year or according to the job type or risk, as well as assessing the possible influence of the hazard and risk that may need to be controlled by preventive efforts. The periodic medical checkup consider as the monitoring database to review the results of MCU for any significant change due to work exposure.

### 3) Special health screening

This special MCU is intended to assess the effects of certain occupations in the workforce or certain workforce groups]. Special health screening is conducted against:

- An accident or illness that requires more than 2 (two weeks) of treatment.
- Manpower over the age of 40 (forty) years or the labor force and labor of Disability, as well as young workers who do certain occupations.
- The manpower that there is certain allegations of health disorders need to be carried out special examinations according to the needs.

## 3. METHODS

The method used in this research is a qualitative approach with the Strategic Assumption Surfacing and Testing (SAST) analysis method. This method is helpful in exposing the critical assumptions that are based on policy, plan or strategy [7]. The SAST method is one method with a system approach that is appropriate for a pluralistic system in consideration of different viewpoints (different worldviews) [8]. The SAST method is used to prioritize assumptions in policy formulation. Further to obtain a decision about the concept of design of medical surveillance program to be taken need to use exponential comparison method (ECM). By the ECM method the most suitable strategy can be selected in accordance with real conditions [9].

The exponential comparison method assessment result of each expert is combined to obtain a combined opinion. Merging is done by multiplying the combined alternate score of each expert and then stepping on the number of experts. The formula of exponential comparison method is:

$$\text{Total value (TN i)} = \sum_{j=1}^m (RK_{ij})^{TKK_j}$$

Description:

- TNi : Total Alternate value to-i
- Rkij: Degrees relative interests to-J criterion on decision to-i
- TKKj: Degrees interests' criteria J decision; From TKKj > 0; Round
- I : 1, 2 ... n
- J : 1, 2 ... m
- N : No decision Amount
- M : Number of decision criteria

The steps that need to be done in the decision selection with ECM are:

- 1) Determination of alternative medical surveillance program
- 2) Preparation criteria of medical surveillance program to be reviewed
- 3) Determination of the relative importance of each decision criteria by using a specific conversion scale according to the wishes of decision makers
- 4) Determination of the relative importance of each decision alternative

Calculate the score or total value of each alternate and sort it. The greater the total value (TN) alternative then the higher the order of precedence.

#### 4. RESULTS AND DISCUSSION

Company XYZ is a company engaged in three big enterprises, namely marine, offshore and industrial engineering. Company XYZ is one of the leading shipyard companies in the Middle East offering a comprehensive range of marine services as well as solutions for the oil and gas industry. The existence of Company XYZ in Marine Industry symbolizes the world-class facilities that have been developed jointly by the Industrial City. The company has a worker of about 2500 people and one of its company services is the work of electroplating (chrome plating) specifically to repair vessels that contain liquefied gas or LNG from and out of Qatar.

Health screening conducted by company XYZ, only done in the clinic when workers come with health complaints, then carried out the necessary examinations and examination according to the recommendation from health personnel. Examination is also only done at the beginning of work then re-conducted according to the examination power recommendation. It is certainly very detrimental for workers because they do not know their health condition during work. If viewed from the level of exposure according to OSHA [10], the level of health risk at the worker is at a high high/risk level (< 2.0 x OEL) due to contact worker with chromium in high frequency, while the chromium used is in the High concentration and with the band's exposure value of 2.5 x OEL. This level is at number 4 of 5 levels of exposure and number 5 is the highest level.

Chromium monitoring in the air is done twice and the second inspection is conducted 19-20 March 2018 against air pollution in company XYZ covers the levels of compound hexavalent chromium, trivalent chromium and lead. At the second monitoring it was found that concentrations of chromium levels of hexavalent in the air with a value of 0.6 mg/m<sup>3</sup>. Limitation of chromium, metal and inorganic compounding as Cr is in the air according to the Agency for Toxic Substances and Disease Registry of 0.5 mg/m<sup>3</sup> [11]. So the value of chromium in air in the Company XYZ has exceeded the allowable value 0.5 mg/m<sup>3</sup>.

The study was conducted by taking respondents from 13 workers of the most aged are 32 years old (46.15%), 29 years old (7.7%) and ages 25, 26, 31, 40, 43 and 49 years old (46.15%). The following respondent based on the job title; an assistant yard manager, a technician/operator, an environment officer, a foreman, a machine operator, 2 mechanical engineers, 2 supervisors, and 4 mechanical fitters.

Judging from the age range, workers at Company XYZ include the age of maturity. The age of maturity who has been competent to do work with high risk of accidents. The respondent's department showed direct contact workers with the exposed to air chromium and most direct contact with the electroplating process. So, workers have a high risk of direct exposed to chromium and high risk of experiencing health disorders.

Respondents who were smoking active 2 people (15%) and 11 people not smoking (85%).

Workers exposed to chromium are less than or equal to 8 hours a day, the average working period of 4 years and the habit of using personal protective equipment (PPE) consistently from workers there 11 people (85%) 2 people don't disciplined in the use of PPE. Worker's working time indicates the length of the worker is exposed to chromium and complies with predefined standards. The respondents' average working period of 4 years showed considerable respondent experience in one field such as electroplating work. Respondents are also accustomed to using the PPE, which is disciplined and consistent. The use of this PPE is an early working step to prevent direct exposure to chromium. Occupational conditions and an air environment in the workplace allow workers to be exposed continuously so that use of the PPE is must.

In the respondents conducted chromium serum tests on blood and urine and results as in the Table.

**Table 1. Blood serum examination results of chromium and urine**

Respondents	Chromium in blood (<0.9 ug/L)	Chromium in urine (<5,00)
1	<0.9	<5,00
2	<0.9	<5,00
3	<0.9	<5,00
4	<0.9	<5,00
5	<0.9	<5,00
6	<0.9	<5,00
7	<0.9	<5,00
8	1,11*	28*
9	<0.9	<5,00
10	1,10*	44*
11	<0.9	<5,00
12	<0.9	<5,00
13	<0.9	<5,00

The above table shows there are 2 respondents who have the value of chromium in the blood and urine above the threshold value (> NAB) While the other respondents are still in normal value. The threshold value is a standard set by the company. The result of the examination of blood chromium and urine levels shows that 2 people have a chromium level above the upper limit value. If viewed from the labor period, both have a working period of more than 4 years in the work of electroplating. The presence of abnormal values can be an indication that the exposure of chromium continuously through air can cause health problems in workers.

Spirometry examination results also showed that workers have respiratory distress. In supporting examination vital signs, full blood count, microscopic urine, liver function, renal function and chest X-Ray all workers are the result within normal limits. In the spirometry examination, 1 person results in mild obstruction, 1 person with restrictive results and 11 people in the normal limit. Respondents with the results of spirometry restrictive have a rate of chromium in blood 1.11 ug/L and respondents with mild obstruction have had a content of chromium 1.10 ug/L in the blood. So there is a correlation of increased levels of chromium in the blood with the patient's perceived health complaints. Restrictive and mild obstructions are disorders of the respiration system.

The basic assumption of evaluation strategy of worker' health monitoring is processed by strategic assumption surfacing and testing (SAST) method. The first step of this method is to form a discussion group consisting of experts in the field of worker health and policy makers. The criteria used are representing the sections of the lead of occupational health department, occupational health and chronic disease physician and occupational health lead nurse. These three experts are being selected based on professional and experiences.

The second step of the SAST method is to review the data of the worker's health in company XYZ, the data of 13 respondents obtained from the examination results done by the company XYZ, the description of air chromium level inspected by the company XYZ as well as the risk level exposure of chromium workers according to OSHA. The data used by the experts to evaluate and provide alternative assumptions to create a worker health monitoring evaluation strategy. The assumptions divided into 3 groups; group of workers, medical surveillance programs and prevention programs. This grouping to show from which group the most important and most definite assumption is.

On the worker group is represented by a single assumption. The examination program is represented by four assumptions and prevention programs represented four assumptions. The assumptions in the worker group identify which group is appropriate for health screening activities. The first assumption is preliminary medical examinations and collection of medical and occupational history. Second, periodic medical examinations at regular scheduled,

including specific medical screening tests when necessary. Third, more frequent and detailed medical examinations, as demonstrated based on findings from this examination. Fourth, post-accident examination and medical screening program after being exposed. The assumption of the prevention program consists of ongoing analysis of data to evaluate the information for the purpose of surveillance, training of workers to recognize the symptoms of exposure to hazards, and written medical reports and corporate actions in response to identification of potential hazards and health risks.

The third step or dialectic phase is where the basic assumption of the worker's health monitoring strategy is divided into two dimensions; dimensions of certainty level and dimension of importance. The dimensional level of certainty shows how much certainty it has been implemented with the 1-6 likert scale. Starting from very uncertain with a value of 1, uncertain with a value of 2, somewhat with a value of 3, certainly with a value of 4, very certain with a value of 5 and most certainly with a value of 6. The dimension of importance shows how important the assumption is, starting from very unimportant to the value 1, not important with the value 2, somewhat important with a value of 3, important with a value of 4, is very important with the value 5 and most important with 6 values. All

alternative assumptions are included in the questionnaire that must be filled by experts.

In the fourth step or the synthesis phase, analyze the data which is collected from experts using the computer based on their assessment. From this data analysis, select the most often value (mode) or the average of all expert values. In the Table 2 show the results of assumption alternative value of evaluation strategy monitoring of health workers at company XYZ.

Table 2 shows the value of assumptions gained from experts and periodic medical examinations at regularly scheduled intervals, including certain medical screening tests when required to have a value of certainty and interest 5. These values will be included in the assumption rating diagram to determine the priority of the assumption against the monitoring evaluation of worker health checks. The rank of assumptions is the basis for decision-making in recommending health screening monitoring strategies.

The next process of the assumption analysis on Table 2 ranked according to the highest value of the importance and certainty level. The level of certainty as axis x and level of importance is made axis y. The ranking results will be included in the assumption rating diagram to determine the priority of the assumption against the monitoring evaluation of the worker's health.

**Table 2. Values assumption of monitoring evaluation strategies for worker's health examination company XYZ**

<b>Code Assumptions</b>	<b>Assumption</b>	<b>Certainty (Axis X)</b>	<b>Significance (Axis Y)</b>
<b>Working Group</b>			
a	Medical surveillance job risk group identification	4,3	5,0
<b>Health Surveillance Program</b>			
b	Pre-employment data, include medical illness and occupational history	4,3	5,0
c	Periodic medical assessment and special medical assessment if required	5,0	5,3
d	Details medical investigation for any abnormal results	4,3	4,3
e	Post incident/exposure medical assessment	4,0	5,0
<b>Preventive Program</b>			
f	Data analysis & evaluation	4,3	5,0
g	Training for worker	3,3	5,3
h	Written medical report	4,0	5,3
i	Company act, policy and related program	5,0	4,3

The below diagram is divided into 4 quadrants. Quadrant 1 is the most important and most definite area. Quadrant 2 is most important but very uncertain area. Quadrant 3 is very important and very uncertain (problematic) area. The 4th quadrant is most uncertain but very insignificant area.

The diagram is the result of a ranking assumption of the monitoring evaluation strategy based on the level of certainty and importance.

Diagram 1 shows the assumption of a worker's health monitoring strategy that is the result of an expert assessment. The chart shows the highest position of periodic medical checkup at regular scheduled intervals, including a specific medical screening test when needed (c), the assumption is included in the prevention program. It has the meaning that periodic medical examinations at regular schedule are crucial and should definitely be implemented because it has many benefits. This assumption also as a preventive program against the influence of chromium on workers. Prevention of the occurrence of poorer health disorders in workers that will decrease productivity.

From the table 3 can be seen the assessment of each alternative policy to be taken and the weight of all criteria that is the result of discussion with experts. Application criteria have the greatest value in comparison with other

criteria, while the largest value of the alternative can be seen from the table.

The table 4 shows that alternate value 2 has the largest value of expert options, followed by alternative 1, alternative 9 in the third order, alternative 3-fourth sequence, alternate 5 in fifth order, alternate 6 in sixth order, alternate 10 in order Seventh, the 7th alternative to the eighth, the 4th alternative to the ninth and the tenth alternate 8.

The first sequence of alternatives is number 2, which is periodic screening. This alternative is a choice of experts on the policy of employee health monitoring strategy because this policy is the right decision given the risk of chromium for workers. Chromium (VI) is harmful to human health, especially for people who work in the steel and textile industry [12]. People who smoke tobacco also have a higher risk of exposure to chromium (VI). If breathing is inhalation of chromium (VI) substances, it can cause irritation and nose bleed and even cause damage to the nose bones. Other health problems caused by chromium (VI) are skin rash, abdominal pain and boils, respiratory problems, weakened immune system, kidney and liver damage, changes in the genetic material, even lung cancer death.

In addition, the exposure of chromium can be inhaled, ingest and contact with the skin. The main organs that are infected with chromium are the lungs, kidneys, liver, skin, reproduction and

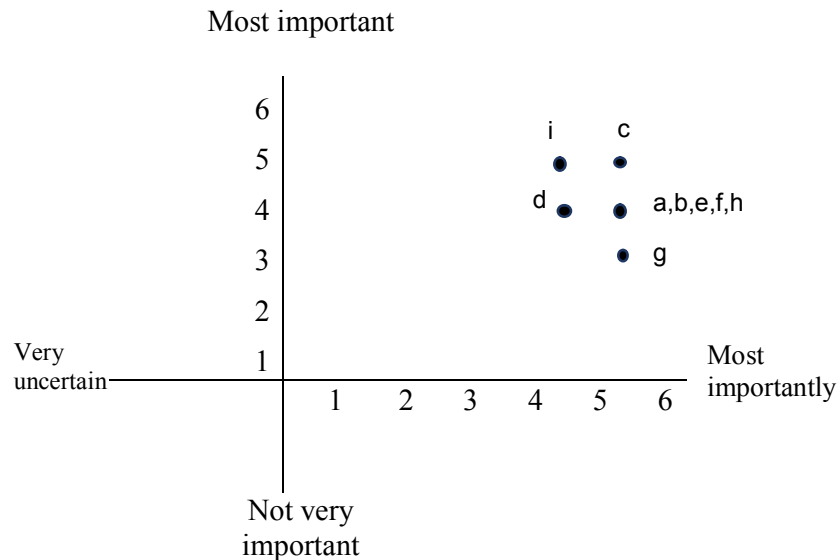


Diagram 1. Ranking assumption of worker health monitoring evaluation strategy

**Tabel 3. Results of alternative policy assessments**

Criteria	Score	Alternative									
		1	2	3	4	5	6	7	8	9	10
Applicability	9	8	8	7	7	7	7	7	6	8	7
Effectiveness	7	8	8	7	5	5	6	5	5	6	7
Sustainability	7	6	7	8	4	7	5	5	5	7	6
Flexibility	7	6	7	8	5	5	5	5	6	6	5
Cost	7	6	7	7	4	8	7	7	6	6	5

**Table 4. Order priority policy based on ECM**

Alternative	ECM Score	Priority
1. Pre-placement health examination	137,154,688	2
2. Periodic medical examination	138,785,509	1
3. Emergency/exposure examination and tests	46,194,997	4
4. Final examination	40,542,625	9
5. Specific examination such skin and respiratory system	43,430,552	5
6. Occupational and Medical history	41,613,336	6
7. Evaluation of ability to wear a respirator	41,411,525	8
8. Additional assessment if required	10,793,818	10
9. Written medical recommendation (physician or other licensed healthcare professional – PLHCP) to employer; employer to employee	135,881,079	3
10. Counseling (results, risks)	41,613,336	7

Immune system. Chromium can also be transferred to embryos via the placenta [13]. For that, periodic assessment is necessary to early detection of the presence of health problems in workers.

Periodic medical checkups (MCU) are conducted on workers with certain periods. The examination of this period is intended to maintain the degree of worker' health after being in its work (usually done once a year or according to the type of work, and assess the likelihood of influence from early work that may need to be controlled by preventive efforts [14].

In the second alternative to the experts options on the preparation of the assessment (pre-placement exam) is a preparation of the risk of exposure to set the basis for the comparison after exposure. It should be known how large the exposure of chromium can be tolerated and the preparation of any examination that needs to be done prior to the worker. This alternative is a second choice given the risk of chromium is very unfortunate for the workers.

Chromium or CR is one of the heavy metals that have high toxic power. The toxic power of chromium is determined by the number of the oxygenated, where the chromium (III) compound in the 3 + oxidation state has a lower level of

toxicity compared to chromium (VI). Chromium is also known as one of the potential pollutants as a result of staining of fabric in textile, paint, tanning, metal plating, battery or other chromium industries. The utilization of chromium in the industry, among others. The criteria of the World Health Organization stated that the normal levels of chromium in the blood range from 0.5 µg/L. As for maximum urine with levels ranging from 11 µg/L later to hair and nail levels of chromium are allowed around 50-1000 ppm.

The third alternative opinion of experts is the written medical opinion of doctors or other health professions that are licensed nationally. This medical opinion is the result of tests that have been done to the workers thoroughly with supporting examinations such as x-rays, blood screening, urine and others. Medical opinions or can be said written medical reports are strong evidence and can be accounted for by medical personnel or healthcare personnel.

The fourth alternative is the examination and an emergency/exposure test. This examination is performed due to the presence of workers who are directly exposed to chromium, such as swallowed, suction or direct contact with the skin. This emergency examination includes a special examination (special MCU) in the healthy concept of workers, this special examination is



intended to assess the influence of certain occupations on labor force or certain workforce, subjected to accidents or illnesses that require treatment more than 2 (two weeks).

According to the Occupational Safety and Health Organization (OSHA) special examination of workers exposed to chromium hexavalent at 2.5 micrograms level for 8 hours of work should be conducted at least once every 6 months, and every 3 months once if it is more than 2.5 microgram.

An alternative to the five expert options is an examination, including special attention to the body's system: skin and respiratory tract. This is the fifth choice with the consideration of exposure through the respiratory tract can occur without the workers realized, while the exposure to the skin can cause direct disruption to the worker. In chromium air in the form of dust particles or particulate matter, dust or chromium particulates that exist in the air can enter into the human body during the activities of respiration.

The amount of chromium that is absorbed through the inhalation depends on the particle size. Particles with a diameter greater than 5 µm will be deposited on the surface of the nasal membrane, trachea, bronchi and pharynx when inhalation. Particles with a diameter of below 2 µm will be deposited in the alveolus [15].

A sixth alternative by the expert is a work and medical history that needs to be studied deeply, focusing on specific body systems, symptoms, personal habits, and or specific families, environmental or employment history. The health status of a person, according to Blum theory, is determined by four factors; environment, behavior, health and genetic services [16].

The next alternative is the counseling of employees who are in the seventh order of expert choice. Employee counseling is required because each worker has the right to know the state of health after the examination. Workers also have the right to know whether he is at risk of exposure and risk of health problems due to chromium exposure.

An alternative to the eighth order of expert choice is the evaluation of the ability to wear respirators. The respirator is a personal protective device that can be worn by workers to prevent the occurrence of chromium exposure in the respiratory system. This alternative needs to be done to know where the worker's ability to use

the tool at work. Chromium exposure in the respiratory system in the form of dust-dust that can enter the alveolus, can even reach deeper organs. The health problems of workers in the respiratory system can be prevented by the use of such respirators. Employers must establish a respiratory protection program in accordance with OSHA'S Respiratory Protection Standard.

An alternative to the ninth order based on the expert opinion is the final examination (termination exam). This termination check is conducted to detect any long-term health disorders related to the work when the employee leaves the company. This examination is conducted due to termination of employment with workers [17,18].

The last alternative by the expert is an additional test if deemed necessary. These additional tests include other checks beyond the focus of the examination. For example, in a worker with the risk of chromium exposure to focus on respiratory and skin, in case of complications can be carried out the examination of the system of the law no. 1 of 1970 article 2 paragraph (3) explains that health screening includes complete physical examinations, physical freshness, lung x-rays (where possible) and routine laboratories, as well as other necessary examinations.

## 5. CONCLUSION

The design of medical surveillance programs in Company XYZ needs to be conducted at the beginning of the project, there should be regular health screening every 6 months, health check should be focused on the integument and respiratory system, it is necessary to gather health and occupational history, such as the presence of chromium exposure in the past, current and anticipated future exposure. The ability to use respirators assessment considers as additional assessment to protect the workers accordingly. The health practitioner require explaining the health screening results and provide the recommendation for each finding to employee as well as to employer for the next health surveillance plan.

## 6. RECOMMENDATION

The fact that there are workers who experiencing health problem due to chemical pollution urges employer to design medical surveillance policy and program that can monitor, protect and control the worker from occupational illness such as the impact from chromium exposure. This

research study with expert method on monitoring worker' health strategy may benefit for developing health and safety policy in Company XYZ and other related Industry.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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