



# ***Don H. Mahaffey Drilling Co.***

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**CADMIUM**

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YOUR OSHA COMPLIANCE SOLUTION

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Questions? Call 1-800-734-3574



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## **1 OBJECTIVE**

This program applies to occupational exposures to cadmium and cadmium compounds, in all forms, at Don H. Mahaffey Drilling Co.. It is the intent of Don H. Mahaffey Drilling Co. to equip employees with the necessary knowledge, environment and equipment to adequately protect themselves from the potential hazardous health effects stemming from exposure to cadmium as well as ensuring compliance with California Code of Regulations, Title 8, Section 1532.

## **2 PROGRAM ADMINISTRATOR**

Don H. Mahaffey Drilling Co. has designated Ashley Mahaffey Tullius as the administrator for this program. Ashley Mahaffey Tullius will be responsible for:

- a. Identifying work areas that could potentially expose employees to cadmium (refer to Appendix 2);
- b. Arranging for exposure evaluations to be conducted;
- c. Maintaining records pertaining to this program;
- d. Evaluating the program on an annual basis (at least); and
- e. Updating the written program, as needed.

## **3 CADMIUM, AN EXPLANATION OF**

### **3.1 General**

Cadmium (Cd) is a naturally-occurring soft, malleable, bluish-white metal found in zinc ores and in the cadmium mineral greenockite. It is commonly used in the lithium-ion batteries, alloys, electroplating, solar cells, plastic stabilizers, pigments and nuclear reactors.

### **3.2 Health Effects**

A highly toxic metal, cadmium is known to cause cancer and target the body's cardiovascular, renal, gastrointestinal, neurological, reproductive and respiratory systems. Acute exposure may result in flu-like symptoms and may cause damage to the lungs. Chronic exposure may result in kidney, bone and lung disease.

## **4 PERMISSIBLE EXPOSURE LIMIT (PEL)**

No employee will be exposed to an airborne concentration of cadmium in excess of 5 micrograms per cubic meter of air ( $5 \mu\text{g}/\text{m}^3$ ), calculated as an 8-hour time-weighted average exposure (TWA).

## **5 EXPOSURE MONITORING**

### **5.1 General**

- 5.1.1 Prior to the performance of any construction work where employees may be potentially exposed to cadmium, it will be determined whether cadmium is present in the workplace and whether there is the possibility that employee exposures will be at, or above, the action level. A competent person will be designated to make this determination. Investigation and material testing techniques will be used, as appropriate, in the determination. Investigation will include a review of relevant plans, past reports, safety data sheets and other available records and consultations with the property owner and discussions with appropriate individuals and agencies.
- 5.1.2 Where cadmium has been determined to be present in the workplace, and it has been determined that there is a possibility the employee's exposure will be at, or above, the action level, the competent person will identify employees potentially exposed to cadmium at, or above, the action level.
- 5.1.3 Determinations of employee exposure will be made from breathing zone air samples that reflect the monitored employee's regular, daily 8-hour time-weighted average (TWA) exposure to cadmium.
- 5.1.4 8-hour TWA exposures will be determined for each employee on the basis of one or more personal breathing zone air samples reflecting full shift exposure on each shift, for each job classification in each work area. Where several employees perform the same job tasks, in the same job classification, on the same shift, in the same work area and the length, duration and level of cadmium exposures are similar, a representative fraction of the employees may be sampled instead of all employees in order to meet this requirement. In representative sampling, the sample will be of those employee(s) expected to have the highest cadmium exposures.

### **5.2 Initial Monitoring**

- 5.2.1 Except as provided for in Section 5.2.3, where a determination conducted under Section 5.1.1 shows the possibility of employee exposure to cadmium at, or above, the action level, exposure monitoring will be conducted as soon as practicable that is representative of the exposure for each employee in the workplace who is, or may be, exposed to cadmium at or above the action level.
- 5.2.2 In addition, if the employee periodically performs tasks that may expose the employee to a higher concentration of airborne cadmium, the employee will be monitored while performing those tasks.
- 5.2.3 Where there is objective data, as defined in Section 18.2, demonstrating that employee exposure to cadmium will not exceed the action level

under the expected conditions of processing, use or handling, such data may be relied upon instead of implementing initial monitoring.

- 5.2.4 Where a determination conducted under Sections 5.1 or 5.2 is made that a potentially exposed employee is not exposed to airborne concentrations of cadmium at, or above, the action level, a written record of such determination will be made. The record will include at least the monitoring data developed under Sections 5.2.1 through 5.2.3, where applicable, and will also include the date of determination and the name and social security number of each employee.

### **5.3 Monitoring Frequency (Periodic Monitoring)**

- 5.3.1 If the initial monitoring or periodic monitoring reveals employee exposures to be at, or above, the action level, monitoring will be at a frequency and pattern needed to assure that the monitoring results reflect with reasonable accuracy the employee's typical exposure levels, given the variability in the tasks performed, work practices and environmental conditions on the job site, and to assure the adequacy of respiratory selection and the effectiveness of engineering and work practice controls.
- 5.3.2 If the initial monitoring or periodic monitoring indicates that employee exposures are below the action level and that result is confirmed by the results of another monitoring taken at least 7 days later, the monitoring for those employees whose exposures are represented by such monitoring may be discontinued.

### **5.4 Additional Monitoring**

The monitoring required under Sections 5.2.1 and 5.3 will be instituted whenever there has been a change in the raw materials, equipment, personnel, work practices or finished products that may result in additional employees being exposed to cadmium at or above the action level or in employees already exposed to cadmium at or above the PEL, or whenever there is reason to suspect that any other change might result in further such exposure.

### **5.5 Employee Notification of Monitoring Results**

- 5.5.1 Each affected employee will be notified, individually and in writing, no later than 5 working days after the receipt of the results of any monitoring performed under this section. In addition, within the same time period, the results of the exposure monitoring will be posted in an appropriate location that is accessible to all affected employees.
- 5.5.2 Wherever monitoring results indicate that employee exposure exceeds the PEL, a statement that the PEL has been exceeded will be included in the written notice along with a description of the corrective action being taken to reduce employee exposure to or below the PEL.



## **5.6 Accuracy of Measurement**

A method of monitoring and analysis will be used that has an accuracy of not less than +/- 25% with a confidence level of 95% for airborne concentrations of cadmium at or above the action level and the permissible exposure limit.

# **6 REGULATED AREAS**

## **6.1 Establishment**

A regulated area will be established wherever an employee's exposure to airborne concentrations of cadmium is, or can reasonably be expected to be, in excess of the permissible exposure limit.

## **6.2 Demarcation**

Regulated areas will be demarcated from the rest of the workplace in any manner that adequately establishes and alerts employees of the boundaries of the regulated area, including employees who are, or may be, incidentally in the regulated areas and that protects persons outside the area from exposure to airborne concentrations of cadmium in excess of the PEL.

## **6.3 Access**

Access to regulated areas will be limited to authorized persons.

## **6.4 Provision of Respirators**

Each person entering a regulated area will be supplied with, and required to use, a respirator selected in accordance with Section 8.2.

## **6.5 Prohibited Activities**

Employees are not allowed to eat, drink, smoke, chew tobacco or gum or apply cosmetics in regulated areas, carry the products associated with these activities into regulated areas or store such products in those areas.

# **7 METHODS OF COMPLIANCE**

## **7.1 Engineering and Work Practice Controls**

7.1.1 Except as specified in Sections 7.1.2, engineering and work practice controls will be implemented to reduce and maintain employee exposure to cadmium at or below the PEL, except to the extent that it can be demonstrated that such controls are not feasible.

7.1.2 The requirement to implement engineering controls to achieve the PEL does not apply where the following can be demonstrated:  
a. The employee is only intermittently exposed; and

- b. The employee is not exposed above the PEL on 30 or more days per year (12 consecutive months).

- 7.1.3 Wherever engineering and work practice controls are not sufficient to reduce employee exposure to, or below, the PEL, such controls will be implemented to reduce exposures to the lowest levels achievable. Such controls will be supplemented with respiratory protection that complies with the requirements of Section 8 and the PEL.
- 7.1.4 Employee rotation will not be used as a method of compliance.

## **7.2 Specific Operations**

- 7.2.1 Abrasive Blasting on cadmium or cadmium-containing materials will be conducted in a manner that will provide adequate protection.
- 7.2.2 Welding, cutting and other forms of heating of cadmium or cadmium-containing materials will be conducted in accordance with the requirements of California Code of Regulations, Title 8, Section 1536 and 1537, where applicable.

## **7.3 Prohibitions**

- 7.3.1 High-speed abrasive disc saws and similar abrasive power equipment will not be used for work on cadmium or cadmium-containing materials unless they are equipped with appropriate engineering controls to minimize emissions if the exposure levels are above the PEL.
- 7.3.2 Materials containing cadmium will not be applied by spray methods if exposures are above the PEL unless employees are protected with supplied-air respirators with full facepiece, hood, helmet, suit, operated in positive-pressure mode and measures are instituted to limit overspray and prevent contamination of adjacent areas.

## **7.4 Mechanical Ventilation**

- 7.4.1 When ventilation is used to control exposure, measurements that demonstrate the effectiveness of the system in controlling exposure such as capture velocity, duct velocity or static pressure will be made as necessary to maintain its effectiveness.
- 7.4.2 Measurements of the system's effectiveness in controlling exposure will be made as necessary within 5 working days of any change in production, process or control that might result in a significant increase in employee exposure to cadmium.
- 7.4.3 Recirculation of Air  
If air from exhaust ventilation is recirculated into the workplace, the system will have a high-efficiency filter and be monitored to assure effectiveness.

- 7.4.4 Procedures will be developed and implemented to minimize employee exposure to cadmium when maintenance of ventilation systems and changing of filters is being conducted.

## **7.5 Exposure Assessment and Control Plan**

- 7.5.1 An exposure assessment (Attachment 2) will be conducted and will include:
- a. A comprehensive description of each operation in which cadmium is emitted;
  - b. The sampling method/procedure;
  - c. Accuracy of method;
  - d. Duration of Sampling;
  - e. Respiratory device used, if any;
  - f. Environmental variables;
  - g. Results of the samples; and
  - h. Employee name, Social Security number and job classification.
- 7.5.2 The Exposure Control Plan (Attachment 3) will include a description of the specific means that will be employed to achieve compliance, including engineering plans and studies used to determine methods selected for controlling exposure to cadmium as well as, where necessary, the use of appropriate respiratory protection to achieve the PEL.

## **8 RESPIRATORY PROTECTION**

### **8.1 General**

Respirators will be provided to employees who are required to wear respirators during:

- a. Periods necessary to install or implement feasible engineering and work practice controls when employee exposure levels exceed the PEL;
- b. Maintenance and repair activities and during those brief or intermittent operations where exposures exceed the PEL and engineering and work practice controls are not feasible or are not required;
- c. Work operations in the regulated areas specified in Section 6;
- d. Work operations for which all feasible engineering and work practice controls have been implemented but are not sufficient to reduce exposure to or below the PEL;
- e. Emergencies;
- f. Work operations for which an employee who is exposed to cadmium at or above the action level requests a respirator; and
- g. Work operations for which engineering controls are not required under Section 7.1.2 to reduce employee exposures that exceed the PEL.

### **8.2 Respirator Program**

- 8.2.1 A Respiratory Protection Program in accordance with California Code of Regulations, Title 8, Section 5144(b) (except (d)(1)(C)) through (m) has been implemented.

- 8.2.2 No employee will wear a respirator when, based upon their most recent examination, the examining physician determines that they will be unable to continue to function normally while using a respirator. If the physician determines the employee must be limited in, or removed from, their current job because of the employee's inability to use a respirator, the job limitation or removal will be in accordance with Sections 13.11 and 13.12.
- 8.2.3 If an employee exhibits breathing difficulty during a fit test or respirator use, the employee will be provided with a medical examination in accordance with Section 13.6.2 to determine if the employee can use a respirator while performing the required duties.

### **8.3 Respirator Selection**

- 8.3.1 The appropriate respirators specified in California Code of Regulations, Title 8, Section 5144(d)(3)(A)(1) will be selected and provided to employees.
- 8.3.2 A powered air-purifying respirator (PAPR) will be provided in lieu of a negative pressure respirator when:
  - a. An employee entitled to a respirator chooses to use this type of respirator; and
  - b. This respirator will provide adequate protection to the employee.
- 8.3.3 Employees will be provided with full facepiece respirators when they experience eye irritation.
- 8.3.4 HEPA filters will be provided for powered and non-powered respirators.

## **9 EMERGENCY SITUATIONS**

### **9.1 Alerting Employees**

- 9.1.1 Where there is the possibility of employee exposure to cadmium due to an emergency, means will be developed to promptly alert employees who have the potential to be directly exposed.
- 9.1.2 Affected employees not engaged in correcting emergency conditions will be evacuated immediately in the event that an emergency occurs. Means will also be developed and implemented for alerting other employees who may be exposed as a result of the emergency.
- 9.1.3 Methods of alerting employees may include one or a combination of the following alarm systems:
  - a. Bells;
  - b. Horns;
  - c. Sirens;
  - d. Workplace announcement system;
  - e. Visual alarms;
  - f. Flashing/Steady lights; and/or

- g. Strobe lights.

## **9.2 Emergency and First Aid Procedures**

- 9.2.1 Employees who are trained will apply first-aid until medical services arrive in the event of an emergency.
- 9.2.2 Employees will be trained on the following basic first-aid procedures:
  - a. Eye and face exposure: If MDA is splashed into the eyes, wash the eyes with water for at least 15 minutes. See a doctor as soon as possible.
  - b. Skin exposure: If MDA is spilled on your clothing or skin, remove the contaminated clothing and wash the exposed skin with large amounts of soap and water immediately. Wash contaminated clothing before you wear it again.
  - c. Breathing: If you or any other person breathes in large amounts of MDA, get the exposed person to fresh air at once. Apply artificial respiration if breathing has stopped. Call for medical assistance or a doctor as soon as possible.
  - d. Swallowing: If MDA has been swallowed and the patient is conscious, do not induce vomiting. Call for medical assistance or a doctor immediately.

## **9.3 Emergency Action Plan**

- 9.3.1 Employees will refer to the Emergency Action Plan for details pertaining to the procedures of identifying and implementing appropriate portions of the plan in the event of an emergency.
- 9.3.2 The plan will specifically provide that employees engaged in correcting emergency conditions will be equipped with the appropriate personal protective equipment and clothing as required until the emergency is abated.
- 9.3.3 The plan will specifically include provisions for alerting and evacuating affected employees as well as the elements prescribed in the, "Emergency action plans" and "Fire prevention plans."
- 9.3.4 Employees will be knowledgeable of the appropriate local emergency services to contact.

# **10 PROTECTIVE WORK CLOTHING AND EQUIPMENT**

## **10.1 Provision and Use**

If an employee is exposed to airborne cadmium in excess of the PEL, or where skin or eye irritation is associated with cadmium exposure at any level, appropriate protective work clothing and equipment that prevents contamination of the employee and the employee's garments will be provided, at no cost to the



employee, and its use will be required. Protective work clothing and equipment includes, but is not limited to:

- a. Coveralls or similar full-body work clothing;
- b. Gloves, head coverings and boots or foot coverings; and
- c. Face shields, vented goggles or other appropriate protective equipment that complies with California Code of Regulations, Title 8, Sections 1514 to 1522.

## **10.2 Removal and Storage**

- 10.2.1 Employees will remove all protective clothing and equipment contaminated with cadmium at the completion of the work shift and do so only in change rooms provided in accordance with Section 11.1.
- 10.2.2 No employee will be allowed to take cadmium-contaminated protective clothing or equipment from the workplace except for employees authorized to do so for purposes of laundering, cleaning, maintaining or disposing of cadmium-contaminated protective clothing and equipment at an appropriate location or facility away from the workplace.
- 10.2.3 Protective clothing and equipment, when removed for laundering, cleaning, maintenance or disposal, will be placed and stored in sealed, impermeable bags or other closed, impermeable containers that are designed to prevent dispersion of cadmium dust.
- 10.2.4 Bags or containers of contaminated protective clothing and equipment that are to be taken out of the change rooms or the workplace for laundering, cleaning, maintenance or disposal will bear labels in accordance with Section 14.3.2.

## **10.3 Cleaning, Replacement and Disposal**

- 10.3.1 The protective clothing and equipment required by Section 10.1 will be provided in a clean and dry condition as often as necessary to maintain its effectiveness, but in any event at least weekly. The protective clothing and equipment will be cleaned and laundered to maintain its effectiveness or will be disposed of properly.
- 10.3.2 Protective clothing and equipment will be repaired or replaced as needed to maintain its effectiveness. When rips or tears are detected while an employee is working, they will be immediately mended or the worksuit will be immediately replaced.
- 10.3.3 The removal of cadmium from protective clothing and equipment by blowing, shaking or any other means that disperses cadmium into the air is prohibited.
- 10.3.4 Laundering of contaminated clothing or cleaning of contaminated equipment in the workplace will be done in a manner that prevents the release of airborne cadmium in excess of the permissible exposure limit prescribed in Section 4.

- 10.3.5 Any person who launders or cleans protective clothing or equipment contaminated with cadmium will be informed of the potentially harmful effects of exposure to cadmium and that the clothing and equipment should be laundered or cleaned in a manner to effectively prevent the release of airborne cadmium in excess of the PEL.

## **11 HYGIENE AREAS AND PRACTICES**

### **11.1 General**

For employees whose airborne exposure to cadmium is above the PEL, clean change rooms, handwashing facilities, showers and lunchroom facilities that comply with California Code of Regulations, Title 8, Sections 1524, 1526 and 1527 will be provided.

### **11.2 Change Rooms**

Change rooms will be equipped with separate storage facilities for street clothes and for protective clothing and equipment which are designed to prevent dispersion of cadmium and contamination of the employee's street clothes.

### **11.3 Showers and Handwashing Facilities**

- 11.3.1 Employees who are exposed to cadmium above the PEL will be required to shower during the end of the work shift.
- 11.3.2 Employees whose airborne exposure to cadmium is above the PEL will be required to wash their hands and faces prior to eating, drinking, smoking, chewing tobacco or gum or applying cosmetics.

### **11.4 Lunchroom Facilities**

- 11.4.1 Lunchroom facilities will be readily accessible to employees, tables for eating are maintained free of cadmium and no employee in a lunchroom facility will be exposed to cadmium at, or above, a concentration of  $2.5 \mu\text{g}/\text{m}^3$  at any time.
- 11.4.2 Employees will not be allowed to enter lunchroom facilities with protective work clothing or equipment unless surface cadmium has been removed from the clothing and equipment by HEPA vacuuming or some other method that removes cadmium dust without dispersing it.

## **12 HOUSEKEEPING**

- 12.1 All surfaces will be maintained as free as practicable of accumulations of cadmium.
- 12.2 All spills and sudden releases of material containing cadmium will be cleaned up as soon as possible.

- 12.3 Surfaces contaminated with cadmium will, wherever possible, be cleaned by vacuuming or other methods that minimize the likelihood of cadmium becoming airborne.
- 12.4 HEPA-filtered vacuuming equipment or equally effective filtration methods will be used for vacuuming. The equipment will be used and emptied in a manner that minimizes the reentry of cadmium into the workplace.
- 12.5 Shoveling, dry or wet sweeping and brushing may be used only where vacuuming or other methods that minimize the likelihood of cadmium becoming airborne have been tried and found not to be effective.
- 12.6 Compressed air will not be used to remove cadmium from any surface unless the compressed air is used in conjunction with a ventilation system designed to capture the dust cloud created by the compressed air.
- 12.7 Waste, scrap, debris, bags, containers, personal protective equipment and clothing contaminated with cadmium and consigned for disposal will be collected and disposed of in sealed impermeable bags or other closed, impermeable containers. These bags and containers will be labeled in accordance with Section 14.3.2.

## **13 MEDICAL SURVEILLANCE**

### **13.1 General**

- 13.1.1 A medical surveillance program will be instituted for all employee who are, or may be, exposed to cadmium at or above the action level unless it can be demonstrated that the employee is not, and will not be, exposed at or above the action level on 30 or more days per year (12 consecutive months).
- 13.1.2 To determine an employee's fitness for using a respirator, the limited medical examination specified in Section 13.6 will be provided.
- 13.1.3 All medical examinations and procedures required by the standard will be performed by, or under the supervision of, a licensed physician who has read, and is familiar with, the health effects section of the safety data sheet for Cadmium, the regulatory text of California Code of Regulations, Title 8, Section 5207 (Cadmium), the protocol for sample handling and laboratory selection in California Code of Regulations, Title 8, Section 5207 (Cadmium) – Appendix F and the questionnaire of Appendix 5. These examinations and procedures will be provided without cost to the employee and at a time and place that is reasonable and convenient to employees.
- 13.1.4 The collecting and handling of biological samples of cadmium in urine (CdU), cadmium in blood (CdB) and beta-2 microglobulin in urine ( $\beta_2$ -M) taken from employees under this section will be done in a manner that assures their reliability. Analysis of biological samples of cadmium in urine (CdU), cadmium in blood (CdB) and beta-2 microglobulin in urine (-

M) taken from employees under this section will be done in a manner that assures their reliability. Analysis of biological samples of cadmium in urine (CdU), cadmium in blood (CdB) and beta-2 microglobulin in urine ( $\beta 2$  -M) taken from employees under this section will be performed in laboratories with demonstrated proficiency for that particular analyte.

## **13.2 Initial Examination**

- 13.2.1 An initial (preplacement) examination will be provided to all employees covered by the medical surveillance program required in Section 13.1.1. The examination will be provided to those employees within 30 days after initial assignment to a job with exposure to cadmium.
- 13.2.2 The initial (preplacement) medical examination will include:
- a. A detailed medical and work history with emphasis on:
    1. Past, present and anticipated future exposure to cadmium;
    2. Any history of renal, cardiovascular, respiratory, hematopoietic, reproductive and/or musculo-skeletal dysfunction;
    3. Current usage of medication with potential nephrotoxic side effects; and
    4. Smoking history and current status; and
  - b. Biological monitoring that includes the following test:
    1. Cadmium in urine (CdU), standardized to grams of creatinine (g/Cr);
    2. Beta-2 microglobulin in urine ( $\beta 2$  -M), standardized to grams of creatinine (g/Cr), with pH specified, as described in California Code of Regulations, Title 8, Section 5207 (Cadmium) – Appendix F; and
    3. Cadmium in blood (Cd), standardized to liters of whole blood (lwb).
- 13.2.3 Recent Examination
- An initial examination is not required to be provided if adequate records show that the employee has been examined in accordance with the requirements of Section 13.2.2 within the past 12 months. In that case, such records will be maintained as part of the employee's medical record and the prior exam will be treated as if it were an initial examination for the purposes of Sections 13.3 and 13.4.

## **13.3 Actions Triggered by Initial Biological Monitoring**

- 13.3.1 If the results of the initial biological monitoring tests show the employee's CdU level to be at or below 3  $\mu\text{g/g Cr}$ ,  $\beta 2$  -M level to be at or below 300-M level to be at or below 300  $\mu\text{g/g Cr}$  and CdB level to be at or below 5  $\mu\text{g/lwb}$ , then:
- a. For currently exposed employees who are subject to medical surveillance under Section 13.1.1(a), the minimum level of periodic medical surveillance in accordance with the requirements in Section 13.4.1 will be provided; and
  - b. For previously exposed employees who are subject to medical surveillance under Section 13.1.1(b), biological monitoring for CdU,

β2 -M and CdB will be provided one year after the initial biological monitoring and the requirements of Section 13.4.6 will be complied with.

- 13.3.2 For all employees who are subject to medical surveillance under Section 13.1.1, if the results of the initial biological monitoring tests show the level of CdU to exceed 3 µg/g Cr, the level of β2 -M to exceed 300 µg/g Cr, or the level of CdB to exceed 5 µg/lwb, Don H. Mahaffey Drilling Co. will:
- a. Within 2 weeks after receipt of biological monitoring results, reassess the employee's occupational exposure to cadmium as follows:
    1. Reassess the employee's work practice and personal hygiene;
    2. Reevaluate the employee's respirator use, if any, and the respiratory protection program;
    3. Review the hygiene facilities;
    4. Reevaluate the maintenance and effectiveness of the relevant engineering controls; and
    5. Assess the employee's smoking history and status;
  - b. Within 30 days after the exposure reassessment specified in Section 13.3.2(a), take reasonable steps to correct any deficiencies found in the reassessment that may be responsible for the employee's excess exposure to cadmium; and
  - c. Within 90 days after receipt of biological monitoring results, provide a full medical examination to the employee in accordance with the requirements of Section 13.4.2. After completing the medical examination, the examining physician will determine in a written medical opinion whether to medically remove the employee. If the physician determines that medical removal is not necessary, then until the employee's CdU level falls to, or below, 3 µg/g Cr, β2 -M level falls to, or below 300 µg/g Cr and CdB level falls to, or below, 5 µg/lwb, Don H. Mahaffey Drilling Co. will:
    1. Provide biological monitoring in accordance with Section 13.2.2(b) on a semiannual basis; and
    2. Provide annual medical examinations in accordance with Section 13.4.2.
- 13.3.3 For all employees who are subject to medical surveillance under Section 13.1.1, if the results of the initial biological monitoring tests show the level of CdU to be in excess of 15 µg/g Cr, or the level of CdB to be in excess of 15 µg/lwb, or the level of β2 -M to be in excess of 1,500 µg/g Cr, the requirements of Sections 13.3.2(a) through 13.3.2(b) will be complied with. Within 90 days after receipt of biological monitoring results, a full medical examination will be provided to the employee in accordance with the requirements of Section 13.4.2. After completing the medical examination, the examining physician will determine in a written medical opinion whether to medically remove the employee. However, if the initial biological monitoring results and the biological monitoring results obtained during the medical examination both show that: CdU exceeds 15 µg/g Cr; or CdB exceeds 15 µg/lwb; or β2 -M exceeds 1500 µg/g Cr, and in addition CdU exceeds 3 µg/g Cr or CdB exceeds 5 µg/liter of whole blood, then the physician will medically remove the employee from exposure to cadmium at, or above, the action level. If the second set of



biological monitoring results obtained during the medical examination does not show that a mandatory removal trigger level has been exceeded, then the employee is not required to be removed by the mandatory provisions of this section. If the employee is not required to be removed by the mandatory provisions of this section or by the physician's determination, then until the employee's CdU level falls to, or below, 3 µg/g Cr, β2-M level falls to, or below, 300 µg/g Cr and CdB levels falls to, or below 5 µg/lwb, Don H. Mahaffey Drilling Co. will:

- a. Periodically reassess the employee's occupational exposure to cadmium;
- b. Provide biological monitoring in accordance with Section 13.2.2(b) on a quarterly basis; and
- c. Provide semiannual medical examinations in accordance with Section 13.4.2.

13.3.4 For all employees to whom medical surveillance is provided and in lieu of Sections 13.3.3, whenever the results of initial biological monitoring tests show the employee's CdU level to be in excess of 7 µg/g Cr, or β2-M level to be in excess of 750 µg/g Cr, or CdB level to be in excess of 10 mg/lwb, Don H. Mahaffey Drilling Co. will:

- a. Comply with the requirements of Sections 13.3.2(a) through 13.3.2(b); and
- b. Within 90 days after receipt of biological monitoring results, a full medical examination will be provided to the employee in accordance with the requirements of Section 13.4.2. After completing the medical examination, the examining physician will determine in a written medical opinion whether to medically remove the employee. However, if the initial biological monitoring results and the biological monitoring results obtained during the medical examination both show that: CdU exceeds 7 µg/Cr; or CdB exceeds 10 µg/lwb; or β2-M exceeds 750 µg/g Cr, and in addition CdU exceeds 3 µg/g Cr or CdB exceeds 5 µg/lwb, then the physician will medically remove the employee from exposure to cadmium at, or above, the action level. If the second set of biological monitoring results obtained during the medical examination does not show that a mandatory removal trigger level has been exceeded, then the employee is not required to be removed by the mandatory provisions of this section. If the employee is not required to be removed by the mandatory provisions of this section or by the physician's determination, then until the employee's CdU level falls to, or below 3 µg/g Cr, β2-M level falls to, or below, 300 µg/g Cr and CdB level falls to, or below, 5 µg/lwb, Don H. Mahaffey Drilling Co. will:
  1. Periodically reassess the employee's occupational exposure to cadmium;
  2. Provide biological monitoring in accordance with Section 13.2.2(b) on a quarterly basis; and
  3. Provide semiannual medical examinations in accordance with Section 13.4.2.

## 13.4 Periodic Medical Surveillance

- 13.4.1 For each employee who is covered under Section 13.1.1(a) because of current or anticipated exposure to cadmium, at least the minimum level of periodic medical surveillance, which consists of periodic medical examinations and periodic biological monitoring, will be provided. A periodic medical examination will be provided within 1 year after the initial examination required by Section 13.2 and thereafter at least biennially. Biological sampling will be provided at least annually, either as part of a periodic medical examination or separately as periodic biological monitoring.
- 13.4.2 The periodic medical examination will include:
- a. A detailed medical and work history, or update thereof, with emphasis on:
    - 1. Past, present and anticipated future exposure to cadmium;
    - 2. Smoking history and current status;
    - 3. Reproductive history;
    - 4. Current use of medications with potential nephrotoxic side effects;
    - 5. Any history of renal, cardiovascular, respiratory, hematopoietic and/or musculo-skeletal system dysfunction; and
    - 6. As part of the medical and work history, for employees who wear respirators, questions 3-11 and 25-32 in Appendix 5;
  - b. A complete physical examination with emphasis on:
    - 1. Blood pressure;
    - 2. The respiratory system; and
    - 3. The urinary system;
  - c. A 14 inch by 17 inch, or a reasonably standard sized posterior-anterior chest X-ray (after the initial X-ray, the frequency of chest X-rays will be determined by the examining physician);
  - d. Pulmonary function tests, including forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV1);
  - e. Biological monitoring as required in Section 13.2.2(b);
  - f. Blood analysis in addition to the analysis required under Section 13.2.2(b), including blood urea nitrogen, complete blood count and serum creatinine;
  - g. Urinalysis in addition to the analysis required under Section 13.2.2(b), including the determination of albumin, glucose and total and low molecular weight proteins;
  - h. For males over 40 years old, prostate palpation, or other at least as effective diagnostic test(s); and
  - i. Any additional tests deemed appropriate by the examining physician.
- 13.4.3 Periodic biological monitoring will be provided in accordance with Section 13.2.2(b).
- 13.4.4 If the results of periodic biological monitoring or the results of biological monitoring performed as part of the periodic medical examination show the level of the employee's CdU,  $\beta$ 2-M, or CdB to be in excess of the levels specified in Sections 13.3.2 or 13.3.3, or in excess of the levels

specified in Sections 13.3.2 or 13.3.4, the appropriate actions specified in Sections 13.3.2 through 13.3.4 will be taken.

- 13.4.5 For previously-exposed employees under Section 13.1.1(b):
- If the employee's levels of CdU did not exceed 3 µg/g Cr, CdB did not exceed 5 µg/lwb, and β2-M did not exceed 300 µg/g Cr in the initial biological monitoring tests, and if the results of the follow-up biological monitoring required by Section 13.1.1(b) 1 year after the initial examination confirm the previous results, all periodic medical surveillance for that employee may be discontinued.
  - If the initial biological monitoring results for CdU, CdB or β2-M were in excess of the levels specified in Section 13.3.1, but subsequent biological monitoring results required by 13.3.2 through 13.3.4 show that the employee's CdU levels no longer exceed 3 µg/g Cr, CdB levels no longer exceed 5 µg/lwb and β2-M levels no longer exceed 300 µg/g Cr, biological monitoring for CdU, CdB and β2-M will be provided 1 year after these most recent biological monitoring results. If the results of the follow-up biological monitoring specified in this section confirm the previous results, all periodic medical surveillance may be discontinued for that employee 1 year after these most recent biological monitoring results. If the results of the follow-up biological monitoring specified in this section confirm the previous results, all periodic medical surveillance may be discontinued for that employee.
  - However, if the results of the follow-up tests specified in Sections 13.4.5(a) or 13.4.5(b) indicate that the level of the employee's CdU, β2-M or CdB exceeds these same levels, annual medical examinations in accordance with the provisions of Section 13.4.2 will be provided until the results of biological monitoring are consistently below these levels or the examining physician determines in a written medical opinion that further medical surveillance is not required to protect the employee's health.
- 13.4.6 A routine, biennial medical examination is not required to be provided in accordance with Sections 13.3.1 and 13.4 if adequate medical records show that the employee has been examined in accordance with the requirements of Section 13.4.2 within the past 12 months. In that case, such records will be maintained as part of the employee's medical records and the next routine, periodic medical examination will be made available to the employee within 2 years of the previous examination.

### **13.5 Actions Triggered by Medical Examinations**

- 13.5.1 If the results of a medical examination carried out in accordance with this section indicate any laboratory or clinical finding consistent with cadmium toxicity that does not require employer action under Sections 13.2, 13.3 or 13.4, the following steps will be taken and continue to be taken until the physician determines that they are no longer necessary:
- Periodically reassess:
    - The employee's work practices and person hygiene;
    - The employee's respirator use, if any;
    - The employee's smoking history and status;

4. The respiratory protection program;
  5. The hygiene facilities;
  6. The maintenance and effectiveness of the relevant engineering controls; and
  7. Take all reasonable steps to correct the deficiencies found in the reassessment that may be responsible for the employee's excess exposure to cadmium;
- b. Provide semiannual medical reexaminations to evaluate the abnormal clinical sign(s) of cadmium toxicity until the results are normal or the employee is medically removed; and
  - c. Where the results of tests for total proteins in urine are abnormal, provide a more detailed medical evaluation of the toxic effects of cadmium on the employee's renal system.

### **13.6 Examination for Respirator Use**

- 13.6.1 To determine an employee's fitness for respirator use, a medical examination will be provided that includes the elements specified in Sections 13.6.1(a) through 13.6.1(d). This examination will be provided prior to the employee being assigned to a job that requires the use of a respirator to any employee without a medical examination within the preceding 12 months that satisfies the requirements of this section.
  - a. A detailed medical and work history, or update thereof, with emphasis on:
    1. Past exposure to cadmium;
    2. Smoking history and current status;
    3. Any history of renal, cardiovascular, respiratory, hematopoietic and/or musculo-skeletal system dysfunction;
    4. A description of the job for which the respirator is required; and
    5. Questions 3-11 and 25-32 in Appendix 5;
  - b. A blood pressure test;
  - c. Biological monitoring of the employee's levels of CdU, CdB and  $\beta$ 2-M in accordance with the requirements of Section 13.2.2(b) unless such results already have been obtained within the previous 12 months; and
  - d. Any other test or procedure that the examining physician deems appropriate.
- 13.6.2 After reviewing all the information obtained from the medical examination required in Section 13.6.1, the physician will determine whether the employee is fit to wear a respirator.
- 13.6.3 Whenever an employee has exhibited difficulty in breathing during a respirator fit test or during use of a respirator, the employee will be provided with a periodic medical examination in accordance with Section 13.4.2 as soon as possible to determine the employee's fitness to wear a respirator.
- 13.6.4 Where the results of the examination required under Section 13.6.1, 13.6.2 or 13.6.3 are abnormal, medical limitation or prohibition of respirator use will be considered. If the employee is allowed to wear a

respirator, the employee's ability to continue to do so will be periodically evaluated by a physician.

### **13.7 Emergency Examinations**

- 13.7.1 In addition to the medical surveillance required in Sections 13.2 through 13.6, a medical examination will be provided as soon as possible to any employee who may have been acutely exposed to cadmium because of an emergency.
- 13.7.2 The examination will include the requirements of Section 13.4.2 with emphasis on the respiratory system, other organ systems considered appropriate by the examining physician and symptoms of acute overexposure as identified in the safety data sheet for Cadmium.

### **13.8 Termination of Employment Examination**

- 13.8.1 At termination of employment, a medical examination in accordance with Section 13.4.2, including a chest X-ray, will be provided to any employee to whom at any prior time Don H. Mahaffey Drilling Co. was required to provide medical surveillance under Sections 13.1.1 or 13.7. However, if the last examination satisfied the requirements of Section 13.4.2 and was less than 6 months prior to the date of termination, no further examination is required unless otherwise specified in Sections 13.3 or 13.5.
- 13.8.2 In addition, if all periodic medical surveillance under Section 13.4.5 is discontinued, no termination of employment medical examination is required.

### **13.9 Information Provided to the Physician**

The following information will be provided to the examining physician:

- a. A copy of California Code of Regulations, Title 8, Section 5207 (Cadmium) and appendices;
- b. A description of the affected employee's former, current and anticipated duties as they relate to the employee's occupational exposure to cadmium;
- c. The employee's former, current and anticipated future levels of occupational exposure to cadmium;
- d. A description of any personal protective equipment, including respirators, used or to be used by the employee, including when and for how long the employee has used that equipment; and
- e. Relevant results of previous biological monitoring and medical examinations.

### **13.10 Physician's Written Medical Opinion**

- 13.10.1 A written, signed medical opinion will be promptly obtained from the examining physician for each medical examination performed on each employee. This written opinion will contain:
  - a. The physician's diagnosis for the employee;
  - b. The physician's opinion as to whether the employee has any detected medical condition(s) that would place the employee at increased risk



- of material impairment to health from further exposure to cadmium, including any indications of potential cadmium toxicity;
  - c. The results of any biological or other testing or related evaluations that directly assess the employee's absorption of cadmium;
  - d. Any recommended removal from, or limitation on the activities or duties of the employee or on the employee's use of personal protective equipment, such as respirators; and
  - e. A statement that the physician has clearly and carefully explained to the employee the results of the medical examination, including all biological monitoring results and any medical conditions related to cadmium exposure that require further evaluation or treatment and any limitation on the employee's diet or use of medications.
- 13.10.2 A copy of the results of any biological monitoring provided by Don H. Mahaffey Drilling Co. to an employee independently of a medical examination under Sections 13.2 and 13.4 will be promptly obtained and, in lieu of a written medical opinion, an explanation sheet explaining those results.
- 13.10.3 The physician will not reveal orally, or in the written medical opinion given to Don H. Mahaffey Drilling Co., specific findings or diagnoses unrelated to occupational exposure to cadmium.

### **13.11 Medical Removal Protection (MRP)**

#### **13.11.1 General**

- a. An employee will be temporarily removed from work where there is excess exposure to cadmium on each occasion that medical removal is required under Sections 13.3, 13.4 or 13.6 and on each occasion that a physician determines in a written medical opinion that the employee should be removed from such exposure. The physician's determination may be based on biological monitoring results, inability to wear a respirator, evidence of illness, other signs or symptoms of cadmium-related dysfunction or disease or any other reason deemed medically sufficient by the physician.
- b. An employee will be medically removed in accordance with Section 13.11 regard of whether at the time of removal a job is available into which the removed employee may be transferred.
- c. Whenever an employee is medically removed under Section 13.11, the removed employee will be transferred to a job where the exposure to cadmium is within the permissible levels specified in Section 4 as soon as one becomes available.
- d. For any employee who is medically removed under the provisions of Section 13.11.1, follow-up biological monitoring will be provided semi-annually until, in a written medical opinion, the examining physician determines that either the employee may be returned to his/her former job status or the employee must be permanently removed from excess cadmium exposure.
- e. An employee who has been medically removed for any reason will not be returned to his/her former job status until a physician determines in

a written medical opinion that continued medical removal is no longer necessary to protect the employee's health.

- 13.11.2 Where an employee is found unfit to wear a respirator under Section 13.6.2, the employee will be removed from work where exposure to cadmium is above the PEL.
- 13.11.3 Where removal is based on any reason other than the employee's inability to wear a respirator, the employee will be removed from work where exposure to cadmium is at, or above, the action level.
- 13.11.4 Except as specified in Section 13.11.5, no employee who was removed because his/her level CdU, CdB and/or  $\beta$ 2-M exceeded the medical removal trigger levels in Sections 13.3 or 13.4 will be returned to work with exposure to cadmium at, or above, the action level until the employee's levels of CdU fall to, or below, 3  $\mu$ g/g Cr, CdB falls to, or below, 5  $\mu$ g/lwb and  $\beta$ 2-M falls to, or below, 300  $\mu$ g/g Cr.
- 13.11.5 When, in the examining physician's opinion, continued exposure to cadmium will not pose an increased risk to the employee's health and there are special circumstances that make continued medical removal an inappropriate remedy, the physician will fully discuss these matters with the employee, and then in a written determination may return a worker to his/her former job status despite what would otherwise be unacceptably high biological monitoring results. Thereafter, and until such time as the employee's biological monitoring results have decreased to levels where he/she could have been returned to his/her former job status, the returned employee will continue medical surveillance as if he/she were still on medical removal. Until such time, the employee is no longer subject to mandatory medical removal. Subsequent questions regarding the employee's medical removal will be decided solely by a final medical determination.
- 13.11.6 Where an employee is removed from exposure to cadmium or otherwise has limitations placed on them due to the effects of cadmium exposure on the employee's medical condition the same medical removal protection benefits will be provided to that employee under Section 13.12 as would have been provided had the removal been required under Section 13.11.

## **13.12 Medical Removal Protection Benefits**

- 13.12.1 Medical removal protection benefits will be provided to an employee for up to a maximum of 18 months each time and while the employee is temporarily medically removed under Section 13.11.

- 13.12.2 For purposes of this section, the requirement that medical protection benefits be provided means that Don H. Mahaffey Drilling Co. will maintain the total normal earnings, seniority and all other employee rights and benefits of the removed employee, including the employee's right to his/her former job status, as if the employee had not been removed from the employee's job or otherwise medically limited.
- 13.12.3 Where, after 18 months on medical removal because of elevated biological monitoring results, the employee's monitoring results have not declined to a low-enough level to permit the employee to be returned to his/her former job status:
- a. A medical examination pursuant to this program will be made available to the employee in order to obtain a final medical determination as to whether the employee may be returned to his/her former job status or must be permanently removed from excess cadmium exposure; and
  - b. The final medical determination will indicate whether the employee may be returned to his/her former job status and what steps, if any, should be taken to protect the employee's health.
- 13.12.4 The provision of medical removal protection may be conditioned upon the employee's participation in medical surveillance provided in accordance with this program.

### **13.13 Multiple Physician Review**

- 13.13.1 If Don H. Mahaffey Drilling Co. selects the initial physician to conduct any medical examination or consultation provided to an employee, the employee may designate a second physician to:
- a. Review any findings, determinations or recommendations of the initial physician; and
  - b. Conduct such examinations, consultations and laboratory tests as the second physician deems necessary to facilitate this review.
- 13.13.2 An employee will be promptly notified of the right to seek a second medical opinion after each occasion that an initial physician provided by Don H. Mahaffey Drilling Co. conducts a medical examination or consultation pursuant to this program. Don H. Mahaffey Drilling Co.'s participation in, and payment for, multiply physician review may be conditioned upon the employee doing the following within 15 days after receipt of this notice, or receipt of the initial physician's written opinion, whichever is later:
- a. Informing Don H. Mahaffey Drilling Co. that he or she intends to seek a medical opinion; and
  - b. Initiating steps to make an appointment with a second physician.

- 13.13.3 If the findings, determinations or recommendations of the second physician differ from those of the initial physician, then Don H. Mahaffey Drilling Co. and the employee will assure that efforts are made for the two physicians to resolve any disagreement.
- 13.13.4 If the two physicians have been unable to quickly resolve their disagreement, then Don H. Mahaffey Drilling Co. and the employee, through their respective physicians, will designate a third physician to:
- Review any findings, determinations or recommendations of the other two physicians; and
  - Conduct such examinations, consultations, laboratory tests and discussions with the other two physicians as the third physician deems necessary to resolve the disagreement among them.
- 13.13.5 Don H. Mahaffey Drilling Co. will act consistently with the findings, determinations and recommendations of the third physician unless Don H. Mahaffey Drilling Co. and the employee reach an agreement that is consistent with the recommendations of at least one of the other two physicians.

#### **13.14 Alternate Physician Determination**

Don H. Mahaffey Drilling Co. and an employee or designated employee representative may agree upon the use of any alternate form of physician determination in lieu of the multiple physician review provided by Section 13.13 so long as the alternative is expeditious and at least as protective of the employee.

#### **13.15 Information Provided to the Employee**

- 13.15.1 A copy of the physician's written medical opinion will be provided to the examined employee within 5 working days after receipt thereof.
- 13.15.2 A copy of the employee's biological monitoring results and an explanation sheet explaining the results will be provided to the employee within 5 working days after receipt thereof.
- 13.15.3 Within 30 days after a request by an employee, the employee will be provided with the information Don H. Mahaffey Drilling Co. is required to provide the examining physician under Section 13.9.

#### **13.16 Reporting**

In addition to other medical events that are required to be reported on the Cal/OSHA Form No. 200, any abnormal condition or disorder caused by occupational exposure to cadmium associated with employment as specified in California Code of Regulations, Title 8, Section 14301 will be reported.

## **14 COMMUNICATION OF CADMIUM HAZARDS TO EMPLOYEES**

### **14.1 Hazard Communication**

Cadmium will be included in the Hazard Communication program established to comply with the Hazard Communication Standard (California Code of Regulations, Title 8, Section 5194). Each employee will have access to labels on containers of cadmium and safety data sheets and will be trained in accordance with the provisions of the Hazard Communication Standard and Section 17. Employees will be provided with information on at least the following hazards:

- a. Cancer;
- b. Lung effects;
- c. Kidney effects; and
- d. Acute toxicity effects.

### **14.2 Warning Signs**

14.2.1 Warning signs will be provided and displayed in regulated areas. In addition, warning signs will be posted at all approaches to regulated areas so that an employee may read the signs and take necessary protective steps before entering the area.

14.2.2 Warning signs required by Section 13.2.1 will bear the following legend:

DANGER  
CADMIUM  
MAY CAUSE CANCER  
CAUSES DAMAGE TO LUNGS AND KIDNEYS  
WEAR RESPIRATORY PROTECTION IN THIS AREA  
AUTHORIZED PERSONNEL ONLY

14.2.3 Signs required by this section will be illuminated, cleaned and maintained as necessary so that the legend is readily visible.

### **14.3 Warning Labels**

14.3.1 Shipping and storage containers containing cadmium or cadmium components will bear appropriate warning labels as specified in Section 14.1.

14.3.2 The warning labels for containers of cadmium-contaminated protective clothing, equipment, waste, scrap or debris will include at least the following information:

DANGER  
CONTAINS CADMIUM  
MAY CAUSE CANCER  
CAUSES DAMAGE TO LUNGS AND KIDNEYS  
AVOID CREATING DUST

14.3.3 Where feasible, installed cadmium products will have a visible label or other indication that cadmium is present.



## **15 OBSERVATION OF MONITORING**

### **15.1 Employee Observation**

Affected employees or their designated representatives will be provided with an opportunity to observe any monitoring of employee exposure to cadmium.

### **15.2 Observation Procedures**

When observation of monitoring requires entry into an area where the use of protective clothing or equipment is required, the observer will be provided with that clothing and equipment and will ensure that the observer uses such clothing and equipment and complies with all other applicable safety and health procedures.

## **16 MULTI-EMPLOYER WORKPLACE**

In a multi-employer workplace, other employers will be notified of the potential hazard of employee exposure to cadmium in accordance with subsection (e) of California Code of Regulations, Title 8, Section 5194 (Hazard Communication Standard) in the event that cadmium is produced, used or stored in a manner that may expose employees of other employers to cadmium.

## **17 EMPLOYEE INFORMATION AND TRAINING**

### **17.1 General**

- 17.1.1 A training program will be instituted for all employees who are potentially exposed to cadmium. Employees will be required to participate in the program and a record of the contents of such program will be maintained.
- 17.1.2 Training will be provided:
  - a. Prior to, or at the time of, initial job assignment to a job involving potential exposure to cadmium; and
  - b. Annually thereafter.

### **17.2 Training Content**

The training program will be made understandable to the employee and will assure that each employee is informed of the following:

- a. The health hazards associated with cadmium exposure, with special attention to the information incorporated in the safety data sheet for Cadmium;
- b. The quantity, location, manner of use, release and storage of cadmium in the workplace and the specific nature of operations that could result in exposure to cadmium, especially exposures above the PEL;
- c. The engineering controls and work practices associated with the employee's job assignment;
- d. The measures employees can take to protect themselves from exposure to cadmium, including modification of such habits as smoking and personal hygiene, and specific procedures that have been implemented to protect

- employees from exposure to cadmium such as appropriate work practices, emergency procedures and the provision of personal protective equipment;
- e. The purpose, proper selection, fitting, proper use and limitations of respirators and protective clothing;
  - f. The purpose, and a description of, the medical surveillance program required by Section 13;
  - g. The contents of California Code of Regulations, Title 8, Section 1532 (Cadmium) and its appendices; and
  - h. The employee's rights of access to records under California Code of Regulations, Title 8, Section 3205(e) and (g).

### **17.3 Additional Access to Information and Training Program and Materials**

- 17.3.1 A copy of California Code of Regulations, Title 8, Section 1532 (Cadmium) and its appendices will be made readily available to all affected employees and will provide a copy without cost if requested.
- 17.3.2 Upon request, all materials relating to the employee information and training program will be provided to the Chief or NIOSH.

## **18 RECORDKEEPING**

### **18.1 Exposure Monitoring**

- 18.1.1 An accurate record of all air monitoring for cadmium in the workplace will be established and kept.
- 18.1.2 This record will include at least the following information:
  - a. The monitoring date, shift, duration, air volume and results in terms of an 8-hour TWA of each sample take and, if cadmium is not detected, the detection level;
  - b. The name, social security number and job classification of all employees monitored and of all other employees whose exposure the monitoring result is intended to represent, including, where applicable, a description of how it was determined that the employee's monitoring result could be taken to represent other employee's exposures;
  - c. A description of the sampling and analytical methods used and evidence of their accuracy;
  - d. The type of respiratory protective device, if any, worn by the monitored employee and by any other employee whose exposure the monitoring result is intended to represent;
  - e. A notation of any other conditions that might have affected the monitoring results; and
  - f. Any exposure monitoring or objective data that were used and the levels.
- 18.1.3 This record will be maintained for at least 30 years in accordance with California Code of Regulations, Title 8, Section 3204 (Access to Employee Exposure and Medical Records).

- 18.1.4 A copy of the results of an employee's air monitoring prescribed in Section 5 will be provided to an industry trade association and to the employee's union, if any, or, if either of such associations or unions do not exist, to another comparable organization that is competent to maintain such records and is reasonably accessible to employers and employees in the industry.

## **18.2 Objective Data for Exemption from Requirement for Initial Monitoring**

- 18.2.1 Objective data are information demonstrating that a particular product or material containing cadmium or a specific process, operation or activity involving cadmium cannot release dust or fumes in concentrations at, or above, the action level even under the worst-case release conditions. Objective data can be obtained from an industry-wide study or from laboratory product test results from manufacturers of cadmium-containing products or materials. The data Don H. Mahaffey Drilling Co. uses from an industry-wide survey will be obtained under workplace conditions closely resembling the processes, types of material, control methods, work practices and environmental conditions in the current operations.
- 18.2.2 This record will be maintained for at least 30 years of the objective data relied upon.

## **18.3 Medical Surveillance**

- 18.3.1 An accurate record will be established and maintained for each employee covered by medical surveillance under Section 13.1.1.
- 18.3.2 The record will include at least the following information about the employee:
- a. Name, social security number and description of duties;
  - b. A copy of the physician's written opinions and of the explanation sheets for biological monitoring results;
  - c. A copy of the medical history and the results of any physical examination and all test results that are required to be provided by this program, including biological tests, X-rays, pulmonary function tests, etc., or that have been obtained to further evaluate any condition that might be related to cadmium exposure;
  - d. The employee's medical symptoms that might be related to exposure to cadmium; and
  - e. A copy of the information provided to the physician as required by Section 13.9.
- 18.3.3 This record will be maintained for the duration of employment plus 30 years in accordance with California Code of Regulations, Title 8, Section 3204 (Access to Employee Exposure and Medical Records).

- 18.3.4 At the employee's request, a copy of the employee's medical record, or update as appropriate, will be promptly provided to a medical doctor or union specified by the employee.

#### **18.4 Training**

- 18.4.1 Don H. Mahaffey Drilling Co. will certify that employees have been trained by preparing a certification record which includes:
- a. The identity of the person trained;
  - b. The signature of the person who conducted the training; and
  - c. The date the training was completed.
- 18.4.2 The certification records will be prepared at the completion of training and will be maintained on file for at least 1 year beyond the date of training of that employee.

#### **18.5 Availability**

- 18.5.1 Except as otherwise provided for in this section, access to all records required to be maintained by Sections 18.1 through 18.4 will be in accordance with the provisions of California Code of Regulations, Title 8, Section 3204 (Access to Employee Exposure and Medical Records).
- 18.5.2 Within 15 days after a request, an employee's medical record required to be kept by Section 18.3 will be made available for examination and copying to the subject employee, to designated representatives, to anyone having the specific written consent of the subject employee, and after the employee's death or incapacitation, to the employee's family members.
- 18.5.3 A copy of this program will be provided, upon request, for examination and copying to affected employees, designated employee representatives as well as to the Chief and NIOSH.

#### **18.6 Transfer of Records**

In the event that Don H. Mahaffey Drilling Co. ceases to do business and there is no successor employer or designated organization to receive and retain records for the prescribed period, Don H. Mahaffey Drilling Co. will comply with the requirements concerning transfer of records set forth in California Code of Regulations, Title 8, Section 3204 (h) (Access to Employee Exposure and Medical Records).

## APPENDIX 1 – DEFINITIONS

**Action Level (AL)** – an airborne concentration of cadmium of 2.5 micrograms per cubic meter of air ( $2.5 \mu\text{g}/\text{m}^3$ ), calculated as an 8-hour time-weighted average (TWA).

**Authorized person** – any person authorized by the employer and required by work duties to be present in regulated areas or any person authorized by the Chief to be in regulated areas.

**Chief** – the Chief of the Division of Occupational Safety and Health, or designee.

**Competent Person** – a person designated by Don H. Mahaffey Drilling Co. to act on Don H. Mahaffey Drilling Co.'s behalf who is capable of identifying existing and potential cadmium hazards in the workplace and the proper methods to control them in order to protect workers and who has the authority necessary to take prompt corrective measures to eliminate or control such hazards. The duties of a competent person include at least the following:

- Determining prior to the performance of work whether cadmium is present in the workplace;
- Establishing, where necessary, regulated areas and assuring that access to and from those areas is limited to authorized employees;
- Assuring the adequacy of any employee exposure monitoring required by this program;
- Assuring that all employees exposed to air cadmium levels above the PEL wear appropriate personal protective equipment and are trained in the use of appropriate methods of exposure control;
- Assuring that proper hygiene facilities are provided and that workers are trained to use those facilities; and
- Assuring that the engineering controls required by this program are implemented, maintained in proper operating condition and functioning properly.

**Emergency** – any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an unexpected and potentially hazardous release of cadmium.

**Employee exposure or similar language referring to the air cadmium level to which an employee is exposed** – the exposure to airborne cadmium that would occur if the employee were not using respiratory protective equipment.

**Final medical determination** – the written medical opinion of the employee's health status by the examining physician under Sections 13.3 – 13.12 or, if multiple physician review under Section 13.13 or the alternative physician determination under Section 13.14 is invoked, it is the final, written medical finding, recommendation or determination that emerges from that process.

**High-efficiency particulate air (HEPA) filter** – a filter capable of trapping and retaining at least 99.97% of mono-dispersed particles of 0.3 micrometers in diameter.

**NIOSH** – the National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

**Regulated area** – an area demarcated by the employer where an employee's exposure to airborne concentrations of cadmium exceeds, or can reasonably be expected to exceed, the permissible exposure limit (PEL).

## APPENDIX 2 – CADMIUM EXPOSURE ASSESSMENT

|                      |                |
|----------------------|----------------|
| <b>Company Name:</b> | <b>Number:</b> |
| <b>Prepared By:</b>  | <b>Date:</b>   |

| Location Assessed | Sampling Method/Procedure | Accuracy of Method | Duration | Respiratory Device Used? | Environmental Variables? | Result of Sample(s) |
|-------------------|---------------------------|--------------------|----------|--------------------------|--------------------------|---------------------|
|                   |                           |                    |          |                          |                          |                     |
|                   |                           |                    |          |                          |                          |                     |
|                   |                           |                    |          |                          |                          |                     |
|                   |                           |                    |          |                          |                          |                     |
|                   |                           |                    |          |                          |                          |                     |
|                   |                           |                    |          |                          |                          |                     |

| Employees Monitored and All Other Represented Measurements |                   |                    |               |                   |                    |
|--|-------------------|--------------------|---------------|-------------------|--------------------|
| Employee Name  | Social Security # | Job Classification | Employee Name | Social Security # | Job Classification |
| 1.   |                   |                    | 7.            |                   |                    |
| 2.   |                   |                    | 8.            |                   |                    |
| 3.   |                   |                    | 9.            |                   |                    |
| 4.   |                   |                    | 10.           |                   |                    |
| 5.   |                   |                    | 11.           |                   |                    |
| 6.   |                   |                    | 12.           |                   |                    |



## APPENDIX 3 – CADMIUM EXPOSURE CONTROL PLAN

|                                |   |
|--------------------------------|---|
| <b>Company Name:</b> _____     |   |
| <b>Address:</b> _____<br>_____ | <b>Date of Implementation:</b> ____/____/____ |

| Air Monitoring Data for Sources of Cadmium Emissions |                                  |          |  |
|--|----------------------------------|----------|--|
| Date:  | Area/Operation Emitting Cadmium: | Results: | Cadmium PEL:   |
|  |                                  |          | 5 µg/m <sup>3</sup> as an 8-hour time-weighted average |
|  |                                  |          |  |
|  |                                  |          |  |
|  |                                  |          |  |
|  |                                  |          |  |
|  |                                  |          |  |
|  |                                  |          |  |
|  |                                  |          |  |
|  |                                  |          |  |
|  |                                  |          |  |

| Controls Implemented to Achieve Compliance |                          |
|--|--------------------------|
| <b>Engineering Controls:</b>               | <b>Date Implemented:</b> |
|  |                          |
|  |                          |
|  |                          |
|  |                          |
| <b>Administrative Controls:</b>            |                          |
|  |                          |
|  |                          |
|  |                          |
|  |                          |
| <b>Work Practice Controls:</b>             |                          |
|  |                          |
|  |                          |
|  |                          |
|  |                          |

*Note: Copies of purchase orders for equipment, construction contracts, etc. are attached.*

## APPENDIX 4 – SUBSTANCE TECHNICAL GUIDELINES FOR CADMIUM

### I. CADMIUM METAL

#### A. Physical and Chemical Data

##### 1. Substance Identification

Chemical name: Cadmium

Formula: Cd

Molecular Weight: 112.4

Chemical Abstracts Service (CAS) Registry No.: 7740-43-9

Other Identifiers: RTECS EU9800000; EPA D006; DOT 2570 53

Synonyms: Colloidal Cadmium; Kadmium (German); CI 77180

##### 2. Physical data

Boiling point: (760 mm Hg): 765 degrees C

Melting point: 321 degrees C

Specific Gravity: (H<sub>2</sub>O = 1 @ 20°C): 8.64

Solubility: Insoluble in water; soluble in dilute nitric acid and in sulfuric acid

Appearance: soft, blue-white, malleable, lustrous metal or grayish-white powder.

#### B. Fire, Explosion and Reactivity Data

##### 1. Fire

Fire and Explosion Hazards: The finely divided metal is pyrophoric, that is the dust is a severe fire hazard and moderate explosion hazard when exposed to heat or flame. Burning material reacts violently with extinguishing agents such as water, foam, carbon dioxide, and halons.

Flash point: flammable (dust)

Extinguishing media: Dry sand, dry dolomite, dry graphite, or sodium chloride.

##### 2. Reactivity

Conditions contributing to instability: Stable when kept in sealed containers under normal temperatures and pressure, but dust may ignite upon contact with air. Metal tarnishes in moist air.

Incompatibilities: Ammonium nitrate, fused: reacts violently or explosively with cadmium dust below 20°C. Hydrozoic acid: violent explosion occurs after 30 minutes. Acids: reacts violently, forms hydrogen gas. Oxidizing agents or metals: strong reaction with cadmium dust. Nitryl fluoride at slightly elevated temperature: glowing or white incandescence occurs. Selenium: reacts exothermically. Ammonia: corrosive reaction. Sulfur dioxide: corrosive reaction. Fire extinguishing agents (water, foam, carbon dioxide, and halons): reacts violently. Tellurium: incandescent reaction in hydrogen atmosphere.

Hazardous decomposition products: The heated metal rapidly forms highly toxic, brownish fumes of oxides of cadmium.

C. Spill, Leak and Disposal Procedures

1. Steps to be taken if the materials is released or spilled.

Do not touch spilled material. Stop leak if you can do it without risk. Do not get water inside container. For large spills, dike spill for later disposal. Keep unnecessary people away. Isolate hazard area and deny entry. The Superfund Amendments and Reauthorization Act of 1986 Section 304 requires that a release equal to or greater than the reportable quantity for this substance (1 pound) must be immediately reported to the local emergency planning committee, the state emergency response commission, and the National Response Center (800) 424-8802; in Washington, D.C. metropolitan area (202) 426-2675.

II. CADMIUM OXIDE

A. Physical and Chemical Data

1. Substance identification

Chemical name: Cadmium Oxide  
Formula:  $\text{CdO}$   
Molecular Weight: 128.4  
CAS No.: 1306-19-0  
Other Identifiers: RTECS EV1929500  
Synonyms: Kadmu tlenek (Polish)

2. Physical data

Boiling point (760 mm Hg): 950 degrees C decomposes  
Melting point: 1500oC  
Specific Gravity: ( $\text{H}_2\text{O} = 1$  @ 20oC): 7.0  
Solubility: Insoluble in water; soluble in acids and alkalines  
Appearance: Red or brown crystals

B. Fire, Explosion and Reactivity Data

1. Fire

Fire and Explosion Hazards: Negligible fire hazard when exposed to heat or flame.

Flash point: Nonflammable

Extinguishing media: Dry chemical, carbon dioxide, water spray or foam.

## 2. Reactivity

Conditions contributing to instability: Stable under normal temperatures and pressures.

Incompatibilities: Magnesium may reduce CdO<sub>2</sub> explosively on heating.

Hazardous decomposition products: Toxic fumes of cadmium.

## C. Spill Leak and Disposal Procedures

### 1. Steps to be taken if the material is released or spilled.

Do not touch spilled material. Stop leak if you can do it without risk. For small spills, take up with sand or other absorbent material and place into containers for later disposal. For small dry spills, use a clean shovel to place material into clean, dry container and then cover. Move containers from spill area. For larger spills, dike far ahead of spill for later disposal. Keep unnecessary people away. Isolate hazard area and deny entry. The Superfund Amendments and Reauthorization Act of 1986 Section 304 requires that a release equal to or greater than the reportable quantity for this substance (1 pound) must be immediately reported to the local emergency planning committee, the state emergency response commission, and the National Response Center (800) 424-8802; in Washington, D.C. metropolitan area (202) 426-2675.

## III. CADMIUM SULFIDE

### A. Physical and Chemical Data

#### 1. Substance Identification

Chemical name: Cadmium sulfide

Formula: CdS

Molecular weight: 144.5

CAS No. 1306-23-6

Other Identifiers: RTECS EV3150000

Synonyms: Aurora yellow; Cadmium Golden 366; Cadmium Lemon Yellow 527; Cadmium Orange; Cadmium Primrose 819; Cadmium Sulphide; Cadmium Yellow; Cadmium Yellow 000; Cadmium Yellow Conc. Deep; Cadmium Yellow Conc. Golden; Cadmium Yellow Conc. Lemon; Cadmium Yellow Conc. Primrose; Cadmium Yellow Oz. Dark; Cadmium Yellow Primrose 47-1400; Cadmium Yellow 10G Conc.; Cadmium Yellow 892; Cadmopur Golden Yellow N; Cadmopur Yellow: Capsebon; C.I. 77199; C.I. Pigment Orange 20; CI Pigment Yellow 37; Ferro Lemon Yellow; Ferro Orange Yellow; Ferro Yellow; Greenockite; NCI-C02711.

2. Physical data

Boiling point (760 mm. Hg): sublimes in N<sub>2</sub> at 980°C

Melting point: 1750 degrees C (100 atm)

Specific Gravity: (H<sub>2</sub>O = 1 @ 20°C): 4.82

Solubility: Slightly soluble in water; soluble in acid.

Appearance: Light yellow or yellow-orange crystals.

B. Fire, Explosion and Reactivity Data

1. Fire

Fire and Explosion Hazards: Negligible fire hazard when exposed to heat or flame.

Flash point: Nonflammable

Extinguishing media: Dry chemical, carbon dioxide, water spray or foam.

2. Reactivity

Conditions contributing to instability: Generally non-reactive under normal conditions. Reacts with acids to form toxic hydrogen sulfide gas.

Incompatibilities: Reacts vigorously with iodine monochloride.

Hazardous decomposition products: Toxic fumes of cadmium and sulfur oxides.

C. Spill Leak and Disposal Procedures

1. Steps to be taken if the material is released or spilled.

Do not touch spilled material. Stop leak if you can do it without risk. For small, dry spills, with a clean shovel place material into clean, dry container and cover. Move containers from spill area. For larger spills, dike far ahead of spill for later disposal. Keep unnecessary people away. Isolate hazard and deny entry.

IV. CADMIUM CHLORIDE

A. Physical and Chemical Data

1. Substance Identification

Chemical name: Cadmium chloride

Formula: CdCl<sub>2</sub>

Molecular weight: 183.3

CAS No. 10108-64-2

Other Identifiers: RTECS EY0175000

Synonyms: Caddy; Cadmium dichloride; NA 2570 (DOT); UI-CAD; dichlorocadmium

2. Physical data

Boiling point (760 mm Hg): 960 degrees C

Melting point: 568 degrees C

Specific Gravity: (H<sub>2</sub>O = 1 @ 20°C): 4.05

Solubility: Soluble in water (140 g/100 cc); soluble in acetone.

Appearance: small, white crystals.

B. Fire, Explosion and Reactivity Data

1. Fire

Fire and Explosion Hazards: Negligible fire and negligible explosion hazard in dust form when exposed to heat or flame.

Flash point: Nonflammable

Extinguishing media: Dry chemical, carbon dioxide, water spray or foam.

2. Reactivity

Conditions contributing to instability: Generally stable under normal temperatures and pressures.

Incompatibilities: Bromine trifluoride rapidly attacks cadmium chloride. A mixture of potassium and cadmium chloride may produce a strong explosion on impact.

Hazardous decomposition products: Thermal decomposition may release toxic fumes of hydrogen chloride, chloride, chlorine or oxides of cadmium.

C. Spill Leak and Disposal Procedures

1. Steps to be taken if the material is released or spilled.

Do not touch spilled material. Stop leak if you can do it without risk. For small, dry spills, with a clean shovel place material into clean, dry container and cover. Move containers from spill area. For larger spills, dike far ahead of spill for later disposal. Keep unnecessary people away. Isolate hazard and deny entry. The Superfund Amendments and Reauthorization Act of 1986 Section 304 requires that a release equal to or greater than the reportable quantity for this substance (100 pounds) must be immediately reported to the local emergency planning committee, the state emergency response commission, and the National Response Center (800) 424-8802; in Washington, D.C. Metropolitan area (202) 426-2675.



## APPENDIX 5 – OCCUPATIONAL HEALTH HISTORY INTERVIEW WITH REFERENCE TO CADMIUM EXPOSURE

### Directions

(To be read by employee and signed prior to the interview)

Please answer the questions you will be asked as completely and carefully as you can. These questions are asked of everyone who works with cadmium. You will also be asked to give blood and urine samples. The doctor will give your employer a written opinion on whether you are physically capable of working with cadmium. Legally, the doctor cannot share personal information you may tell him/her with your employer. The following information is considered strictly confidential. The results of the tests will go to you, your doctor and your employer. You will also receive an information sheet explaining the results of any biological monitoring or physical examinations performed.

If you are just being hired, the results of this interview and examination will be used to:

- 1) establish your health status and see if working with cadmium might be expected to cause unusual problems,
- 2) determine your health status today and see if there are changes over time, and
- 3) see if you can wear a respirator safely.

If you are not a new hire:

OSHA says that everyone who works with cadmium can have periodic medical examinations performed by a doctor.

The reasons for this are:

- 1) if there are changes in your health, either because of cadmium or some other reason, to find them early, and
- 2) to prevent kidney damage.

Please sign below.

I have read these directions and understand them:

\_\_\_\_\_  
Employee signature                      Date

Thank you for answering these questions.

Name: \_\_\_\_\_ Age: \_\_\_\_\_

Social Security Number: \_\_\_\_\_

Company: \_\_\_\_\_

Job: \_\_\_\_\_

Type of Preplacement Exam:

☐ Periodic      ☐ Termination      ☐ Initial      ☐ Other: \_\_\_\_\_

Blood Pressure: \_\_\_\_\_ Pulse Rate: \_\_\_\_\_

1. How long have you worked at the job listed above?

☐ Not yet hired      \_\_\_\_\_ Number of months      \_\_\_\_\_ Number of years

2. Job duties, etc.

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3. Have you ever been told by a doctor that you had bronchitis?      ☐ Yes      ☐ No

If yes, how long ago?      \_\_\_\_\_ Number of months      \_\_\_\_\_ Number of years

4. Have you ever been told by a doctor that you had emphysema?      ☐ Yes      ☐ No

If yes, how long ago?      \_\_\_\_\_ Number of months      \_\_\_\_\_ Number of years

5. Have you ever been told by a doctor that you had other lung problems?      ☐ Yes      ☐ No

If yes, please describe type of lung problems and when you had these problems:

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6. In the past year, have you had a cough?      ☐ Yes      ☐ No

If yes, did you cough up sputum?      ☐ Yes      ☐ No

7. Have you ever smoked cigarettes?      ☐ Yes      ☐ No

8. Do you now smoke cigarettes?      ☐ Yes      ☐ No

9. a. If you smoke or have smoked cigarettes, for how many years have you smoked or did you smoke?  
☐ Less than 1 year      \_\_\_\_\_ Number of years
- b. What is or was the greatest number of packs per day that you have smoked?  
 \_\_\_\_\_ Number of packs
- c. If you quit smoking cigarettes, how many years ago did you quit?  
☐ Less than 1 year      \_\_\_\_\_ Number of years
- d. How many packs a day do you now smoke?  
 \_\_\_\_\_ Number of packs per day

10. Have you ever been told by a doctor that you had a kidney or urinary tract disease or disorder? ☐ Yes ☐ No

11. Have you ever had any of these disorders?

|                                |                              |                             |
|--------------------------------|------------------------------|-----------------------------|
| Kidney stones                  | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Protein in urine               | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Blood in urine                 | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Difficulty urinating           | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Other kidney/urinary disorders | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

Please describe problems, age, treatment and follow-up for any kidney or urinary problems you have had:

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12. Have you ever been told by a doctor or other health care provider who took your blood pressure that your blood pressure was high? ☐ Yes ☐ No

13. Have you ever been advised to take any blood pressure medication? ☐ Yes ☐ No

14. Are you presently taking any blood pressure medication? ☐ Yes ☐ No

15. Are you presently taking any other medication? ☐ Yes ☐ No

16. Please list any blood pressure or other medications and describe how long you have been taking each one:

| Medicine | How long taken? |
|----------|-----------------|
| _____    | _____           |
| _____    | _____           |
| _____    | _____           |
| _____    | _____           |
| _____    | _____           |

17. Have you ever been told by a doctor that you have diabetes? ☐ Yes ☐ No  
(sugar in your blood or urine)

If yes, do you presently see a doctor about your diabetes? ☐ Yes ☐ No

If yes, how do you control your blood sugar?

☐ Diet alone

☐ Diet plus oral medicine

☐ Diet plus insulin (injection)

18. Have you ever been told by a doctor that you had:  
Anemia ☐ Yes ☐ No  
A low blood count ☐ Yes ☐ No

19. Do you presently feel that you tire or run out of energy sooner  
than normal or sooner than other people your age? ☐ Yes ☐ No

If yes, for how long have you felt that you tire easily?

☐ Less than 1 year \_\_\_\_\_ Number of years

20. Have you given blood within the last year? ☐ Yes ☐ No

If yes, how many times? \_\_\_\_\_ How many times?

How long ago was the last time you gave blood?

☐ Less than 1 year \_\_\_\_\_ Number of years

21. Within the last year, have you had any injuries with heavy bleeding? ☐ Yes ☐ No

If yes, how long ago?

☐ Less than 1 year \_\_\_\_\_ Number of years

Describe:

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22. Have you recently had any surgery? ☐ Yes ☐ No

If yes, please describe:

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23. Have you seen any blood lately in your stool or after a bowel  
movement? ☐ Yes ☐ No

24. Have you ever had a test for blood in your stool? ☐ Yes ☐ No  
If yes, did the test show any blood in the stool? ☐ Yes ☐ No  
What further evaluation and treatment were done?

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**The following questions pertain to the ability to wear a respirator. Additional information for the physician can be found in the Respiratory Protective Devices Manual.**

25. Have you ever been told by a doctor that you have asthma? ☐ Yes ☐ No  
If yes, are you presently taking any medication for asthma? Mark all that apply.  
☐ shots ☐ pills ☐ inhaler
26. Have you ever had a heart attack? ☐ Yes ☐ No  
If yes, how long ago? \_\_\_\_\_ Number of years \_\_\_\_\_ Number of months
27. Have you ever had pains in your chest? ☐ Yes ☐ No  
If yes, when did it usually happen?  
☐ While resting ☐ While working ☐ While exercising  
☐ Activity didn't matter
28. Have you ever had a thyroid problem? ☐ Yes ☐ No
29. Have you ever had a seizure or fits? ☐ Yes ☐ No
30. Have you ever had a stroke (cerebrovascular accident)? ☐ Yes ☐ No
31. Have you ever had a ruptured eardrum or a serious hearing problem? ☐ Yes ☐ No
32. Do you now have a claustrophobia, meaning fear of crowded or closed-in spaces, or any psychological problems that would make it hard for you to wear a respirator? ☐ Yes ☐ No

**The following questions pertain to reproductive history.**

33. Have you or your partner had a problem conceiving a child? ☐ Yes ☐ No  
If yes, specify: ☐ self ☐ present mate ☐ previous mate

34. Have you or your partner consulted a physician for a fertility or other reproductive problem? ☐ Yes ☐ No

If yes, specify who consulted the physician:

☐ self ☐ spouse/partner ☐ self and partner

If yes, specify diagnosis made:

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35. Have you or your partner ever conceived a child resulting in a miscarriage, still birth or deformed offspring? ☐ Yes ☐ No

If yes, specify:

☐ miscarriage ☐ still birth ☐ deformed offspring

If outcome was a deformed offspring, please specify type:

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36. Was this outcome a result of a pregnancy of:  
☐ yours with present partner ☐ yours with a previous partner

37. Did the timing of any abnormal pregnancy outcome coincide with present employment? ☐ Yes ☐ No

List dates of occurrences:

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38. What is the occupation of your spouse or partner?

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**For women only:**

39. Do you have menstrual periods?

☐ Yes ☐ No

Have you had menstrual irregularities?

☐ Yes ☐ No

If yes, specify type:

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If yes, what was the approximated date this problem began?

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Approximate date problem stopped? 

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**For men only:**

40. Have you ever been diagnosed by a physician as having prostate gland problem(s)?

☐ Yes ☐ No

If yes, please describe type of problem(s) and what was done to evaluate and treat the problem(s):

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