DEPARTMENT OF THE NAVY
NAVAL SAFETY CENTER
375 A STREET
NORFOLK, VA 23511-4399

IN REPLY REFER TO

5100
Ser 09FB/1071
30 December 2004

Jonathan L. Snare
Deputy Assistant Secretary of Labor (OSHA)(Acting)
U.S. Department of Labor
OSHA Docket Office
Docket No. H054A, Room N-2625
200 Constitution Avenue, NW
Washington, DC 20210

Dear Mr. Snare:

Please find enclosed the U.S. Navy Response to your 4 October 2004 *Federal Register* Request for Information on Occupational Exposure to Hexavalent Chromium: Proposed Rule.

In order to provide a comprehensive response to the 65 questions in the Preamble, Section II, Issues, as well as comments on the Proposed Standards, the Navy, with the coordination of the Naval Sea Systems Command, assembled a team of experts ("Team") to focus on the 65 questions from the prospective of public and private shipyards. Members of the team included professionals from the Naval Sea Systems Command and major Naval Shipyards, Navy Bureau of Medicine and Surgery/Navy Environmental Health Center, Naval Air Systems Command, and Naval Facilities Engineering Command. Maritime industry representatives, including shipping trade associations and private shipyards, provided the Team with information about the proposed standard. Information on the Team and its members is provided as an attachment to the enclosed Response.

Based on the Team's analysis, two pivotal points in the Response include:

1. The Team differs with OSHA's conclusion that in almost all cases shipyards will be capable of complying with the Permissible Exposure Limit (PEL) of 1 $\mu g/m^3$ in a short time-frame without the use of respirators by using engineering controls and work practices combined with new technological developments.

Ser 09FB/1071
30 December 2004

2. The Team believes that OSHA's preliminary economic analysis underestimates the financial impact on the maritime industry by underestimating the number of potentially affected personnel and, consequently, the overall monetary impact in terms of training, engineering controls, exposure assessment, respiratory protection programs and personal protective equipment.

Should you have questions regarding the information provided in the enclosed Response, we are available to respond at your convenience. Our point of contact is Joy Erdman, MS, CIH, CSP, who may be reached at 703) 602-2575.

JOHN C. NOULIS
Captain, U. S. Navy
Deputy Special Assistant for Safety
By direction of the
Chief of Naval Operations
Assistant for Safety

Enclosure: U.S. Navy Response to OSHA's Proposed Rule on Occupational Exposure to Hexavalent Chromium

Copy to:
DASN (Safety)
CMC (SD)
COMNAVSEASYSCOM
COMNAVAIRSYSCOM
CHBUMED
NAVENVHLTHCEN

U.S. Navy Response to Request for Information on Occupational Exposure to Hexavalent Chromium: Proposed Rule, October 4, 2004

EXECUTIVE SUMMARY

On 4 October 2004, the Occupational Safety and Health Administration (OSHA) issued a Proposed Rule to amend the existing standard for hexavalent chromium (Cr (VI)). OSHA is proposing separate regulatory texts for general industry, construction, and shipyards (Maritime) in order to tailor requirements to these specific industry sectors. Under the coordination of the Navy Sea Systems Command (NAVSEA), a Navy Team ("Team") chronicled in Attachment (1) has prepared a response to OSHA's invitation for written comments regarding discussions presented in the Preamble to the Proposed Rule. The Navy Team was not structured to specifically examine the toxicological or medical aspects of Cr (VI). The Team did not examine the validity of models that extrapolated high dose exposures and effects to low dose exposures; studies examining how Cr (VI) is metabolized and detoxified by the body; or studies to show how Cr (VI) is toxicologically significant. The main thrust of the Team was to consider actual ways that workers in shipyards and associated work areas are exposed to Cr (VI), exposure concentrations in Navy workplaces, the actual control measures used, economic conditions, and fiscal impacts of meeting the requirements of the proposed OSHA Cr (VI) standard.

The Team's responses to OSHA's 65 Questions in the Preamble are summarized as follows:

- The Team supports OSHA's proposal to have a separate Maritime Standard, specifically the proposed Maritime Standard that uses performance-based concepts. Performance-based concepts are the most effective approach to protect workers in the shipyard's unique work environment and they are also the most cost-effective.
- OSHA's feasibility analysis is incorrect in concluding that shipyards will be able to meet the proposed permissible exposure limit (PEL) of 1 $\mu g/m^3$ in the foreseeable future using only currently available engineering controls and work practices along with the described new technological developments in welding, cutting, and burning processes on stainless steel and other high-chrome alloys, as well as some other processes in certain confined and enclosed areas. To meet the proposed PEL in the above-described conditions, the use of respirators will be required.
- OSHA's preliminary economic analysis greatly underestimates the impact on the Maritime Industry, specifically, the number of potentially affected personnel and the number of personnel exposed above the proposed PEL. Therefore, the cost impact, which is based on the number of personnel involved, is also significantly underestimated in terms of costs for training, engineering controls, exposure assessment, respiratory protection, other personal protection equipment, and medical surveillance. For example:

  - Number of hot workers potentially exposed to Cr (VI): OSHA's estimate is 4,666 vs. the Team's estimate of 21,031.

- Number of workers (painters and paint removal personnel) involved with painting potentially exposed to Cr (VI): OSHA's estimate is 3,154 vs. the Team's estimate of 6,700.

- Number of workers (hot workers and painters and paint removal personnel) potentially exposed above the proposed PEL: OSHA's estimate is 2,482 vs. the Team's estimate of between 6,934 and 8,320.

- Training costs associated with the new standard for all potentially exposed workers: OSHA's estimate is $292,703 for the Maritime Industry vs. the Team's estimate of more than $1 million for the first year for one hour of training for each 27,734 hot workers and painters and paint removal personnel.

The impact of the proposed PEL in a range of 0.5 to 10 µg/m^3 for Cr (VI) was provided to OSHA in a 1995 Navy Impact Report (see Attachment 2 for a list of references) prepared by the Team. In preparing its responses to OSHA's 65 Questions concerning the proposed Standard for hexavalent chrome with a PEL of 1 µg/m^3, the Team considered the Report, along with additional data and studies conducted by the Navy and Maritime Industry subsequent to 1995. All information and data used in the Team's evaluation of the proposed Standard is in the Docket for this Proposed Rule change or attached hereto.

Based on the 1995 Report, updated as described above, the Team's review of the Proposed Standard with a PEL of 1 µg/m^3 concludes that this PEL will have a significant technical and economic impact on Navy ships, weapon systems and facilities, and on contractors and subcontractors that manufacture and repair weapon systems for the Navy. The use of the performance-based concepts in OSHA's proposed Maritime Standard is the most effective approach to protect workers in the shipyard's unique work environment and is also the most cost-effective approach; therefore, the performance-based concepts will significantly reduce the cost of executing the Standard. However, with the PEL at 1 µg/m^3, there will still be a significant cost impact. It may not be economically practical to achieve exposures under a time weighted average (TWA) level of 1 µg/m^3 for all Navy activities and shipyards. A higher PEL, i.e., 5 µg/m^3 or 10 µg/m^3 in the original range being considered by OSHA in 1995, would be much more feasible while achieving a significant reduction from the existing PEL of 52 µg/m^3. These conclusions are supported by the following findings:

- The following operations have the potential for worker exposure to Cr (VI) above 1 µg/m^3:
  - Metal Cleaning (including abrasive blasting, grinding, and chipping) of chromate-coated materials;
  - Electroplating of chromium and chromic acid etching of pipes;
  - Welding, Thermal Spraying, Thermal Cutting, and Gouging on base materials and with consumables containing chromium, including stainless steels, high-chromium nickel alloys (e.g., Alloys 600 and

625), and HY-80 and HY-100 low-alloy steels. HY steels are particularly widely used in Navy structures and weapon systems.

- Replacement of the processes and materials that contain or generate Cr (VI) will not be possible in the foreseeable future. These materials and processes have been selected based on their performance in Navy systems. Substitutes with equal or better performance are unavailable.

- OSHA's technological assessment suggests that additional controls, including the use of fume extraction guns, and replacing SMAW processes will reduce 95% of the potential exposures that are above the 1 $\mu g/m^3$ to below the proposed PEL. This is an unrealistic conclusion based on an overly optimistic application of control methods and misinterpretation of the available data. As discussed in the response to Question 15, this use of the additional controls is not practical in a shipyard environment in confined and enclosed spaces where they would be of the most benefit in reducing exposure.

- Local exhaust ventilation in enclosed and confined spaces, which is the presently available engineering control, is not completely effective in reducing welder exposure to below 1 $\mu g/m^3$ for many shipyard operations that involve welding or cutting alloys containing high chrome content and other processes (or in some cases, even below 5 $\mu g/m^3$), thus requiring a significant increase in use of respirator protection.

- The Team estimates that if the Cr (VI) PEL is decreased to 1 $\mu g/m^3$, nearly 27,731 Maritime industry workers will be affected. This estimate represents 17 Navy facilities, 5 private shipbuilders (Navy contractors) and over 100 small marine businesses.

- Based on 1995 numbers—current numbers may be somewhat higher—the Team estimates that significantly fewer workers (3,200) are likely to be affected if the Cr (VI) PEL is established at 5 $\mu g/m^3$. This number will be fewer than 800 workers if the PEL is set at a value of 10 $\mu g/m^3$. Accordingly, all costs would be reduced based on the lower number of affected workers.

This Response consists of the following four sections:

- I. Background
- II. Responses to Relevant Issues – Section II. Issues of the Preamble (65 Questions)
- III. General Recommendations/Conclusions
- IV. Attachments

This Response is focused on the Maritime Industry. The Naval Air Force prepared comments on the General Industry aspects that are presented as Attachment 4.

U.S. Navy Response to Request for Information on Occupational Exposure to Hexavalent Chromium: Proposed Rule, October 4, 2004 Federal Register

I. Background

The Occupational Safety and Health Administration (OSHA) issued a Proposed Rule to amend the existing standard for hexavalent chromium (Cr (VI)). OSHA is proposing separate regulatory texts for general industry, construction, and shipyards (Maritime) in order to tailor requirements to these specific industry sectors. This document is a response to OSHA's invitation for written comments regarding discussions presented in the Preamble, with specific comments on the Proposed Rule published in the Federal Register, Vol. 69, No. 191, Monday, October 4, 2004, pages 59306 through 59474. This document supplements previous submissions provided in the following documents:

1) "Impact of Proposed OSHA Hexavalent Chromium Worker Exposure Standard on Navy Manufacturing and Repair Operations," Navy/Industry Team, 13 October 1995; and
2) "Additional Information on Hexavalent Chromium in Navy Workplaces: Addendum to the Original Report to OSHA (November 2002).

II. Responses to Relevant Issues – Section II. Issues of the Preamble (65 Questions)

In this section of the Preamble to the Proposed Rule change, OSHA requested comments on relevant issues, including health effects, risk assessment, significant risk determination, technological and economic feasibility, and the provisions of the proposed regulatory text. OSHA requested this information in the form of 65 questions. The Navy Team ("Team") has developed a consensus response to each of these 65 questions as delineated herein below. In the responses, OSHA's question is paraphrased or quoted directly, based on the complexity and length of the question, except for questions 1 through 9, which are not shown.

Questions 1 through 9 – We have no additional information to offer regarding health effects or epidemiological studies. The Team was not structured to specifically examine the toxicological aspects of Cr (VI). The Team's main thrust was to consider actual ways that workers in shipyards and associated work areas are exposed to Cr (VI), the actual control measures used, economic conditions, and fiscal impacts of meeting the requirements of the proposed OSHA C (VI) Standard.

Question 10 – ***OSHA presented a profile of the affected worker population with estimates by application group, job category and distribution of exposures. OSHA is asking for additional data to refine the profile of the worker population.***

Comment:
Note: References to exhibits in Docket H054A are Ex. 35-391: Preliminary Economic and Initial Regulatory Flexibility Analysis for OSHA's Proposed Standard for Occupational Exposure to Hexavalent Chromium, and Ex. 35-413: Task 1 – Current Shipyard Practice submitted to the MARITECH ASE Program by the Edison Welding Institute.

The Team believes that significantly more employees in the Maritime Industry will be affected by this regulation than indicated in the Preamble. This may also be true for welding in other sectors to the extent that Maritime sampling data was used to estimate exposures.

Table IX-2, "Exposure Profile by Application Group for Cr (VI)", of the Preamble indicates that 4,666 welders and other hot workers represent the potentially exposed population (from below the level of detection (LOD)) up to greater than 20 µg/m^3), with 833 of those potentially exposed over 1 µg/m^3. This information is based on Table III-12 of Ex. 35-391. A review of the data used to generate that Table shows the following reasons why the actual number of personnel affected by this proposed regulation is higher:

- OSHA's assumption appears to be that only welders, cutters and burners who work with stainless steel and other metals containing more than 10% chromium are affected. Review of the data presented indicates that in some cases, welding using materials with as low as 0.4 % chromium may produce occasional potential exposures over the proposed PEL of 1µg/m^3. In this regard, hot workers, including welders, ship fitters, sheet metal workers, pipe fitters, maintenance personnel and others—not just welders—could be involved in operations with a potential exposure above the proposed PEL. While such operations may be adequately controlled through engineering, it places an increased burden on the Maritime industry for controls and employee training, which is not accounted for in the economic section.

- Secondly, workers in small shipyards are multi-task workers, and for welding high chrome alloys there are more qualified personnel than assumed in OSHA's analysis. For example, in Table II-5 (Ex. 35-391), the 111 businesses (1-19 employees) reported to do some welding on stainless steel are assumed to have a total of 111 qualified stainless steel welders. This is an unrealistically low estimate.

- Another affected group in the Maritime Industry are hot workers in Navy yards. Note that the Maritime sampling data provided come from both public and private shipyards; however, it is unclear how government employees in the public yards are included in OSHA's estimates.

Our data review also shows that the distribution of workers in the Table III-12 (Ex. 35-391) is not accurate and leads to an understatement of the anticipated exposure. For example, there are 11 processes listed in this table. OSHA distributes the 4,666 "stainless steel welders" across the 11 processes; however, one individual is likely to use several of these processes throughout the course of a year. Additionally, there is an error in the exposure distribution due to two misinterpretations of the data provided. While most of the sampling data used for this table appear to have been limited to stainless steel work, a large proportion of the data used for FCAW is actually for work with low-chromium steels, and the distribution by welding process derived in part from Ex.-413 is the distribution appropriate for welding on all materials, not specifically stainless steel. Based on data provided by shipyards in that reference, the usage of GMAW and FCAW was similar, with SMAW about three times higher than either (page 10 of Ex.-413). Also, as discussed further herein below, the Team estimates the percentage of hot workers potentially exposed over 1 µg/m^3 to be between 25% and 30%, which calculates to between 5,258 and 6,309 hot workers.

The National Shipbuilding Research Program's Safety and Health Advisory Committee (SHAC) recently conducted a survey of potentially exposed hot workers (those who incur Cr (VI) exposures of below LOD to greater than 20 µg/m^3) in the shipbuilding industry including job classifications such as welders, ship fitters, sheet metal workers, pipe fitters, maintenance personnel and others. This survey showed the current estimated number of Maritime hot workers incurring this Cr (VI) exposure to be 21,031 compared to 4,666 in Table IX-2. of the Preamble**.** This same survey showed the estimated number of painters and paint removal personnel who incur this Cr (VI) exposure to be 6,700 compared to 3,154 in Table IX- 2, of the Preamble. A breakdown of the estimated number of hot workers is as follows:

Private major shipyard A:	4,500
Private major shipyard B:	2,050
Private major shipyard C:	1,400
Private major shipyard D:	5,000
Private major shipyard E:	1,500
Over 100 smaller shipyards:	2,500
Naval shipyards & facilities:	4,081
Total:	21,031

These numbers show an increase in the number of affected hot work personnel from those reported in Ref. (1). This is due to: 1) increased use of stainless steel in a program to reduce corrosion control costs, 2) increased use of high-strength, corrosion-resistant alloys containing higher chrome content, 3) a shift to multi-tasking in the shipyard workforce, and 4) inclusion of additional small shipyards not included in Ref. (1) estimate.

In Table IX of the Preamble, OSHA estimates the total number Maritime workers exposed above 1 µg/m^3 to be 2,482. This estimate includes welding (hot workers) and painting (painters and paint removal personnel). OSHA's estimate is incorrect. The Team estimates this number to be between 25%-30% of the hot workers and painters and paint removal personnel, which calculates to between 6,934 and 8,320. These percentages are based on an estimate obtained by Naval facilities of 29% of the workers in these categories have a greater than acceptable risk of being exposed to above the proposed PEL.

Recommendation: The Tables and Exhibits noted in the above Comments should be corrected as indicated. These Tables and Exhibits on the number of affected workers are used as a basis in OSHA's economic analysis, which also should be amended to reflect the correct number of affected workers. See the summary at the end of the response to Question 15 for a more detailed discussion of this issue.

Question 11: ***OSHA is requesting job categories, description of operations, number of individuals potentially exposed to hexavalent chromium, and additional exposure data.***

Comment:
This information was previously provided by the documents: (1) "Impact of Proposed OSHA Hexavalent Chromium Worker Exposure Standard on Navy Manufacturing and Repair Operations," Navy/Industry Team, 13 October 1995; (2) "Additional Information on Hexavalent Chromium in Navy Workplaces: Addendum to the Original Report to OSHA (November 2002); and (3) expose data on Cr (VI) from private and Navy Shipyards submitted to OSHA in April of 2004 at the request of OSHA at the 2004 Maritime Advisory Committee for Occupational Safety and Health (MACOSH) meeting.

The job categories that involve potential exposures to Cr (VI) include: 1) all hot work including welding, plasma cutting, gas torch cutting, pipe welding, and arc gouging; 2) any metal etching processes with chromic acid surface treatment and chrome electroplating operations; 3) older ship overhaul/renovation projects that may involve the removal of chromate coatings via abrasive blasting, sanding, or grinding; and, 4) older ship overhaul/renovation projects that may involve hot work on chromate coatings, such as torch cutting. Welding exposure measurements (8 Hr TWAs) for these various job categories have been provided in reports and submittals to OSHA discussed above that are on the docket. The reports are listed in Attachment (2). As requested, additional personal exposure assessments conducted since the Navy's response to OSHA's request for information (Ex. 31-8-1) are in Attachment (3).

Question 12: ***OSHA is asking if there have been technological changes within our industry that have influenced the magnitude, frequency, or duration of exposure to Cr (VI) or the means by which employers attempt to control exposures. OSHA would like a description in detail of these technological changes and their effects on Cr (VI) exposures and methods of control.***

Comment:
In 2000, the Naval and commercial shipyard community joined together as a Team to explore new and existing technologies and processes to reduce hexavalent exposure. In 2003, the Team produced the Final Report on Reduction of Worker Exposure and Environmental Release of Welding Emissions, Docket Item 35-411. There is currently no "one size fits all" solution. The report identified several technologies that can reduce hexavalent chromium exposure:

- Pulsed current Gas Metal Arc Welding (GMAW).
- Local exhaust ventilation equipment and specially shaped welding ventilation hoods that are properly sized, properly positioned and are moved to maintain effectiveness relative to the position of the welding being done.
- Fume-extraction welding guns used in the flat, horizontal and overhead positions.

While these technologies can be applied in many cases, there are numerous cases in which the welding ventilation hood cannot fit into the workspace and where energy sources are limited. While improved fume capture was achieved with the fume extraction guns, ergonomic concerns arose with this technology because the gun is heavier, the grip wider and the hoses less flexible. Also, the gun and hoses and other equipment associated with the gun cannot be used in the majority of the confined and enclosed spaces due to accessibility problems. Therefore, the gun is not useful in areas where it could make a difference. This could be a case of creating an additional stressor (see response to Question 15).

The Team also identified mechanization and automation as an effective engineering control, and there are ongoing efforts to further reduce the use of SMAW and replace it with pulsed current GMAW for both efficiency and health considerations. In most cases, reduction of SMAW has already occurred in new construction yards to the extent feasible. However, while these technologies may be appropriate for new construction shipyards, the Navy and overhaul shipyards, unlike production facilities, perform maintenance and repair on existing ships that may have considerable impediments to access, and each weld job is unique depending on location and need.

Availability of durable, effective, and portable self-contained local exhaust ventilation (LEV) equipment to ventilate welding operations remains limited. Also, in a typical hull design, the ability to adequately provide LEV ductwork to affected workers is restricted by the limited number of utility accesses.

In addition to the considerable amount of stainless steel and specialty alloy welding that currently takes place at shipyards, the Navy has specified many new outfitting items (stanchions, electrical foundations, etc.) on current production ships and on overhaul/repair to be fabricated with stainless steel for corrosion control purposes. This will increase the overall Cr (VI) exposures in the workplace.

Question 13: ***OSHA is asking if there has been a trend within our industry to eliminate Cr (VI) from production processes, products and services. If so, OSHA is requesting comments on the success of substitution efforts. Commenters should estimate the percentage of reduction in Cr (VI) that is still necessary in their processes within product lines or production activities. OSHA also requests that commenters describe technical, economic or other deterrents to substitution*.**

Comment:
Since the mid-1990s, a concerted effort has been made to substitute less hazardous material in new ship construction. One of many materials targeted for substitution are those containing chromium. However, Navy specifications require the use of alloys containing chromium to meet identified performance requirements. These chrome-containing alloys have no technically acceptable alternatives.

The Navy and private shipyards been involved in several projects to reduce worker exposures to Cr (VI) in shipyards and repair/overhaul facilities. Reports on the results of these projects are on the Docket and listed in Attachment (2). The results of some of these projects are discussed in the Response to Question 15.

For technological reasons, the series of ships currently being designed (destroyers, cruisers, and smaller vessels) specify the fabrication of composite (fiberglass, Kevlar®, carbon fiber, etc.) deckhouses. This should contribute to the reduction of Cr (VI) exposures to a relatively small extent.

Question 14: ***OSHA is inquiring if any job category or employee in a workplace has exposures to Cr (VI) that raw air monitoring data do not adequately portray due to the short duration, intermittent or non-routine nature, or other unique characteristics of the exposure.***

Comment:
No information to offer.

Question 15: ***OSHA requests the following information regarding engineering and work practice controls in your workplace or industry: a. Describe the operations in which the proposed PEL is being achieved most of the time by means of engineering and work practice controls. b. What engineering and work practice controls have been implemented in these operations? c. For all operations in facilities where Cr (VI) is used, what engineering and work practice controls have been implemented? If you have installed engineering controls or adopted work practices to reduce exposure to Cr (VI), describe the exposure reduction achieved and the cost of these controls. Where current work practices include the use of regulated areas and hygiene facilities, provide data on the implementation of these controls, including data on the costs of installation, operation, and maintenance associated with these controls. d. Describe additional engineering and work practice controls which could be implemented in each***

operation where exposure levels are currently above the proposed PEL to further reduce exposure levels. e. When these additional controls are implemented, to what levels can exposure be expected to be reduced, or what percent reduction is expected to be achieved? f. What are the costs and amount of time needed to develop, install and implement these additional controls? Will the added controls affect productivity? g. Are there any processes or operations for which it is not reasonably possible to implement engineering and work practice controls within two years to achieve the proposed PEL? If so, would allowing additional time for employers to implement engineering and work practice controls make compliance possible? How much additional time would be necessary?

Comment:
a. Exposures are generally maintained within the proposed PEL when welding and other hot work processes (welding, plasma cutting, gouging, etc.) take place on carbon/alloy steel outside or in large enclosed spaces only. There is potential for exposure above the proposed PEL when welding these same materials in confined spaces or tight, enclosed spaces. There is a definite potential for exposure above the proposed PEL where hot work processes take place on stainless and specialty alloys. Exposures during chromic acid dip tank etching can be presumed to create exposures beyond the proposed PEL; however, there is a fixed-slot ventilation hood that maintains exposures below the proposed PEL. Therefore, currently when using existing engineering and workplace controls there is a potential for exposures above the proposed PEL when welding mild and low alloy steel, and the proposed PEL frequently will not be achieved when welding stainless steel and specialty alloys.

b. Flexible local exhaust ventilation tubes are used at shipyards as a primary engineering control. However, efficiency depends on the length and sizes of ductwork that must be employed and on worker diligence in maintaining the opening of the ventilation tube close to the fume source.

c. Shipyards currently have no hygiene facilities or regulated areas dedicated for Cr (VI). With respect to the current OSHA PEL of 52 $\mu g/m^3$ (as Cr (VI)), exhaust ventilation and respiratory protection as needed are presently required during welding on chromium-alloyed steels because of the potential to exceed the PEL.

The exposure reduction achieved with the use of ventilation has not been determined because baseline sampling has not been performed without it. At one of the larger private shipyards, the annual costs associated with using flexible local exhaust ventilation tubes as a primary means of engineering control amount to $1,015,920. Depending on shipyard size, this cost is considered typical.

<u>Current Existing Cost Summary</u>:

New ventilation tubes to replace worn and damaged tubes -	$130,000/yr
Replace/maintain fans -	$ 24,800/yr
Employees to relocate/maintain fans and ventilation tubes on ships/shops (fully-burdened cost) -	$861,120/yr

d. The proposed PEL of 1 $\mu g/m^3$ would greatly expand the number of covered operations requiring both engineering controls and respiratory protection. Because of the ever-changing work environment in shipyards, engineering controls and work practices cannot be relied upon to maintain Cr (VI) levels below 1 $\mu g/m^3$ in some operations involving alloys containing high chrome; therefore, respiratory protection will also be required. In addition, other operations involving low-alloy chromium steels, such as welding, burning and grinding, will now require the presence of local exhaust ventilation not currently required. The net effect will be a significantly greater need for exhaust fans and ductwork to be installed and maintained for hot workers whose work assignments may result in airborne Cr (VI) levels above the proposed PEL as well as increased use of respiratory protection.

Whether or not the proposed PEL can be achieved through the use of engineering and work practice controls depends primarily on the operation being conducted and the environment in which it is being conducted. Due to the varying environment aboard a ship during new construction and overhaul and repair, engineering and work practice controls cannot be relied upon to achieve compliance with the proposed PEL. The proposed PEL is so low that in rare instances hot work operations such as welding and grinding on mild steel in enclosed and confined spaces can result in exposures above the proposed PEL.

Sampling data obtained to date include some with exhaust ventilation in place and other without exhaust ventilation in place. Sampling data on hot work when chromium alloyed steels are worked in a shipboard environment with effective exhaust ventilation in place will yield Cr (VI) levels significantly above the proposed PEL.

Depending on the material being hot-worked, the effectiveness of the ventilation in consistently reducing exposure levels to below the proposed PEL will depend heavily on the space (i.e., confined, enclosed, open), the ability to position exhaust ventilation in close proximity to the point of operation, and general shipboard conditions (i.e., presence or absence of a fan house in the compartment, competing air currents in the space, etc.)

e. In the Maritime welding section of Technological Feasibility in Ex. 35-391, OSHA states that it “preliminarily finds that it is technologically feasible [to] reduce worker [exposure] to at or below the proposed 1$\mu g/m^3$ PEL as an eight-hour TWA for all job categories in most work environments through the use of a combination of engineering controls, process modifications and improved work practices.” (Page III-59). In the Maritime painting section, a similar, but less forceful statement is made.

Based on this conclusion, Table IX-3 of the Preamble indicates that only 41 welders and 520 painters and blasters in the Maritime Industry will require respiratory protection after full implementation of improved engineering controls and work practices.

The first factor that leads to the unrealistic conclusion that the Maritime Industry can feasibly control exposures to all but 41 welders appears to be based on an overly optimistic application of control methods, compounded by a misinterpretation of the available data.

The technological assessment suggests that additional controls, including use of fume extraction guns and replacing SMAW processes with pulse-arc GMAW processes will reduce 95% of the potential exposures that are currently over 1µg/m^3 to below this proposed PEL.

- Fume extraction guns can be applied in open areas, but have limited effectiveness for shipyard applications. OSHA's feasibility analysis did not adequately focus on the difficulty of accessing areas of ships during construction and repair activities. While welding fume extraction guns were evaluated in trials at several shipyards and found to be efficient in reducing fume exposure, they were also found to be difficult to work with in hard-to-access areas of ships and to have limited practical use in other areas because of the need for a close collection device. The size, weight, and impediments related to moving equipment through limited accesses create additional problems for personnel attempting to transport dedicated fume removal and collection equipment to the weld site. Consequently, the guns could not be used effectively in enclosed and confined spaces where engineering controls cannot in all instances reduce the Cr (VI) fumes below the PEL due to accessibility problems. They could not be used where they could make a difference in the shipyards' ability to reduce Cr (VI) exposure below the PEL, and this makes them impractical for shipyard use. Even if it were feasible, moving these guns and associated equipment to and from the job site could result in increased falls and ergonomic hazards, which are already the leading cause of serious injury in the Maritime Industry. Therefore, the use of welding fume extraction guns have not been adopted by the shipbuilding industry, and future use of them is not anticipated.

- While GMAW would provide more decreased potential exposure than SMAW, the opportunities are not as extensive as implied in OSHA's documentation. GMAW, in the pulse-arc mode in particular, provides additional equipment movement concerns in limited access areas. It should be noted that most of the applications where it is feasible to use GMAW instead of SMAW are already converted for efficiency and cost considerations. SMAW, the grandfather of the welding processes, still has places where it is the best, if not the only choice, from a process application viewpoint. SMAW can be used in hard-to-reach areas where other processes cannot. This is especially important in ship overhaul and repair. In outside areas, SMAW is considerably more tolerant of wind than any other process. Other suggestions in the Technological Feasibility documentation include welding booths and downdraft ventilation tables, which are currently in use in many areas but are generally limited for work on components in shops. For example, it would be impractical to use these types of controls on platens where work is done on plates, ship sections or shipboard.

- Temporary ventilation remains the primary engineering control in the shipyard environment. Temporary ventilation for fume control consists of portable blowers stationed at access-convenient sites, generally topside or on a large open-deck area, with flexible duct extended to the hot work location. Currently, improving this system is feasible in limited cases only. The enclosure inherent in shipbuilding, which makes temporary ventilation the method of choice, also presents difficulties. OSHA's documentation does credit the difficulties of controlling potential exposures in confined spaces, but it misses the significance of the effect enclosure has on the ability to implement engineering controls in other areas. In Maritime, an "enclosed space" could refer to ship spaces very similar in size to confined spaces as well as to larger areas and interior shop spaces. The wide range of types of enclosed spaces contributes to the complexity of controlling fumes to the level that OSHA's Proposed Regulation would require. On ships or in modules it is often not feasible to have the ventilation fan close to the operation, thus long runs of flexible duct, sometimes hundreds of feet, are necessary to reach the job.

The second factor that led to an incorrect conclusion in the feasibility of achieving $1 \mu g/m^3$ for the welding processes referenced above is OSHA's misinterpretation of the data provided by the Maritime Industry.

- A significant portion of the data described in Ex. 35-391 is for steel with less than 2% chromium, not for stainless steel or other high chromium alloys. For example, the lowest values for the FCAW process in Table III-12 of that exhibit represent sampling on mild steel. The impact of this is to dilute the actual potential exposures resulting from welding on stainless.

- The impact is further diluted by basing control conclusions on the use of the median exposure instead of a more inclusive criterion such as a 95^{th} percentile, a 95 % confidence level, or other cutoff point. Additionally, the data are from various types of spaces (about 5% confined, a variety of enclosed spaces from shipboard to shops, and open spaces). From this data, it is not reasonable to assume that if half of the potential exposures can be controlled below the PEL, then 100% can be controlled, as OHSA does. Employers are expected to protect all employees, not just those with median exposures and below. Thus, OSHA made a significant error in its analysis in using median exposure that further dilutes the impact of the proposed PEL instead of using a more inclusive criteria typically used in analysis.

The Team also notes a technical error in the documentation. Contrary to what is indicated in Ex. 35-391, gas-shielded FCAW produces more fume than GMAW because of the higher oxidizing potential of the shielding gas used with FCAW, resulting in some increase in hexavalent chromium. A project conducted by one shipyard attempted to lower the FCAW fume production by utilizing the same shielding gas as is generally used for GMAW, with specially designed and tested electrodes; however, this created porosity concerns with the weld, making the amended FCAW "ultra-low fume" process not viable at this time.

f. Other than the currently used flexible local exhaust ventilation tubes, there are no new effective, feasible controls that can significantly further reduce the exposure to Cr (VI) in areas of concern (i.e., confined and enclosed spaces) in shipbuilding and repair. More extraction by flexible local exhaust ventilation tubes is impractical in most cases in these areas because of limited accessibility, and respiratory protection may be required.

g. Due to the nature of the shipbuilding and ship repair environment, it will not be feasible to meet the PEL of 1µg/m^3 without the use of respiratory protection for the following operations:

• SMAW on stainless steel and other high chrome materials in confined and enclosed spaces.
• FCAW on stainless steel and other high chrome materials in confined and enclosed spaces.
• GMAW in confined and tight, enclosed spaces.
• Cutting and burning processes on stainless steel in confined and tight, enclosed areas.
• Hot work processes on affected surfaces coated with chromate containing paints.
• Removal of high chrome paints in confined and enclosed spaces.
• Abrasive blasting of high chrome paints.

On the above operations, it is not reasonably possible to implement engineering and work practice controls within two years to achieve the proposed PEL. Since 1998, the Navy and Maritime Industry have been actively involved in R & D Programs to reduce Cr (VI) exposures to shipyard personnel and repair facilities. Notwithstanding, at this time the Team remains unaware of available feasible technology that would enable the proposed PEL to be met on these operations in the future without the use of respirator protection. Such an extensive, long-term use of respirator protection is cost-prohibitive and contrary to good worker protection practices.

In summary, OSHA's Economic Analysis is incorrect by a significant factor due to the agency's underestimating the number of affected employees and errors in its Technical Feasibility Analysis. These errors are discussed in responses to Questions 10 and 15 and in more detail in the NSRP/ SHAC Report, "Analysis of the Occupational Safety and Health Administration's Proposed Standard on Occupational Exposure to Hexavalent Chromium," Dec. 2004. This Report is being submitted to OSHA by NSRP/SHAC for inclusion in Docket No. HO54A. Considering the anticipated cost increases when OSHA's economic and technological feasibility analyses are corrected based on the findings identified herein, the Team concludes that meeting the PEL will likely be cost-prohibitive as well as impractical.

Question 16: ***OSHA requested information on whether there are limited or unique conditions or job tasks where engineering or work practice controls are not available or are not capable of reducing exposure levels below the proposed PEL.***

Comment:
Data to support not being able to reach 1 µg/m^3 are provided in the response to Question 15 above. OSHA has acknowledged the uniqueness of the shipbuilding and repair industry through promulgation of 29 CFR 1915 addressing Shipyard Employment.

The nature of most welding operations in shipbuilding is such that the associated local exhaust ventilation must be easily movable and temporary, hence the reduced performance within the system due to long ventilation ducts that do not achieve optimum laminar air flow due to ridges and bends. Nevertheless, the approach of using flexible local exhaust ventilation offers some degree of efficiency and is technically and economically feasible in most work conditions. However, from workplace personal air monitoring, it has been clearly demonstrated that these flexible exhaust ducts do not reduce exposure levels to or below the proposed PEL where welding, plasma cutting or gouging takes place on stainless steel and certain specialty alloys. Confined spaces present a condition in which this type of ventilation may not effectively reduce exposures to or below the proposed PEL even when welding, cutting, or gouging takes place on low alloy or mild steel. Therefore, respiratory protection would be relied upon.

Question 17: ***In its Preliminary Economic Analysis, OSHA presents estimated baseline levels of use of personal protective equipment (PPE) and the incremental costs associated with the proposed standard. OSHA is asking if estimated compliance and cost rates are reasonable.***

Comment:
OSHA's estimate of specific types of PPE costs appears to be reasonably accurate with regard to the number of employees in the industry who work with certain types and forms of CrVI compounds. However, OSHA may not have fully realized the potential costs of providing respiratory protection since the number of welders and hot workers has been underestimated at 4,666 in Table IX-2. Recent estimates indicate that the number of welders and other hot workers in the Maritime Industry reaches 21,031. Sampling data from the industry reveal welding and other hot work on chromium-alloyed steels to be consistently above the proposed PEL. Welding and other hot work on mild steels show variability ranging from below the limit of detection (LOD) to above the proposed PEL. This is primarily due to the unpredictable variability encountered in shipboard work conditions. Therefore, in many cases, employees who conduct welding and other hot work in general will be expected to participate in a respiratory protection program under the Proposed Standard. The estimated annual cost for a fully implemented respiratory protection program is $288 per employee. The total cost of providing a respiratory program to employees conducting welding and other hot work in the Maritime industry and are potentially exposed above the proposed PEL is estimated to be $6,056,928. This figure includes provisions for respirators, filters/cartridges, replacement parts, medical

surveillance, fit testing, training, washing/maintenance of respirators, and associated labor.

Question 18: ***In its Preliminary Economic Analysis, OSHA presented estimated baseline levels of communication of Cr (VI)-related hazards and the incremental costs associated with the additional requirements for communication in the proposed standard. OSHA requested information on hazard communication programs addressing Cr (VI) that are currently being implemented by employers and any necessary additions to those programs that are anticipated in response to the proposed standard. OSHA is inquiring if baseline estimates and unit costs for training are reasonable and consistent with current industry practice***.

Comment:
Shipyards currently provide hazard communication (HAZCOM) training covering generic hazard topics to all employees. The training was designed after the OSHA model for hazard communication training with the exception of special mention of certain chemical hazards such as lead, asbestos, chromium, and manganese. Although this current HAZCOM training mentions hexavalent chromium, it is anticipated that a new Cr (VI) standard may require a separate training forum of greater content and depth than what would be intended for specific employees working in certain trades. 29CFR1915.1026 (i)(3***)*** describes specific information that must be communicated to "employees who are exposed to airborne Cr (VI) or who have eye or skin contact with Cr (VI)". This required information is above and beyond current hazard communication information that is delivered to personnel.

Table IX-4 estimates information and training costs to be approximately $292,703 for the entire Maritime Industry. The Maritime Industry's population of 21,031 hot workers and 6,700 painters and paint removal personnel will be required to participate in training. OSHA's estimated cost, which includes only welders, is significantly underestimated. Shipyards estimate that these employees will require one hour of such training to meet compliance. At least once every two to three years, refresher training will be necessary to communicate workplace changes and re-emphasize the hazards of Cr (VI) and required control measures. The Team estimates that this cost would be more than $1 million for the first year for the one hour of training for each of the affected personnel.

OSHA's estimate of baseline training costs is unreasonable based on the number of actual employees potentially impacted in the Maritime Industry.

Question 19: ***OSHA is asking if difficulties will be encountered by small entities when attempting to comply with requirements of the proposed standard. Can any of the proposal's requirements be deleted or simplified for small entities, while still protecting the health of employees? Would a longer time allowed for compliance for small entities make a difference to their ability to comply?***

Comment:
Due to the fact that small business entities have fewer employees and resources, the proposed PEL will have a disproportionately detrimental affect. The U.S. Small Business Administration (SBA) estimates the costs per employee incurred by small businesses to be 60 percent higher than those faced by their larger counterparts. The proposed rule includes provisions including controlling exposure, medical surveillance, respiratory protection, hazard communication, protective work clothing and equipment, hygiene areas, and record keeping. Small business costs in implementing the numerous requirements necessary to comply with such a drastic lowering might force some to cease operations.

Shipbuilders Council of America (SCA) member Lyon Shipyard, Inc. actively participated in the Small Business Regulatory Enforcement Fairness Act (SBREFA) process and noted the impact the proposed PEL would have on small business shipyards.

A longer time frame allowed for compliance for small entities would have limited benefit in the ability to comply with testing procedures. Currently, as an industry standard practice, hexavalent chromium is not tested for. The purchase of solitary Cr (VI) testing equipment and training will need time.

However, the proposed permissible exposure limit (PEL) set at 1.0 $\mu g/m^3$ as an 8-hour time-weighted average remains the most significant problem small businesses must address. A delay in the implementation process will not help since it will not raise that level or address OSHA's drastic underestimation of the economical analysis on small business entities.

Question 20: ***OSHA, in its Preliminary Economic Analysis (PEA), has estimated by application group the compliance costs per affected entity and the likely impacts on revenues and profits under alternative market scenarios. OSHA requests that affected employers provide comment on their estimate of revenue, profit, and the impacts of costs for their industry or application group. OSHA is asking if there are special circumstances—such as unique cost factors, foreign competition, or pricing constraints—that OSHA needs to consider when evaluating economic impacts for particular application groups.***

Comment:
OSHA's preliminary economic analysis greatly underestimates the impact on the Maritime Industry, as described earlier in responses to other questions. OSHA's analysis underestimates the number of potentially affected personnel, and, therefore, the overall cost impact to the Maritime Industry in terms of training, engineering controls, exposure assessments, respiratory protection and other personal protective equipment, and medical surveillance. OSHA's preliminary economic analysis should be corrected. As discussed in the response to Question 15, the Team concludes that meeting the PEL would be cost-

prohibitive as well as impractical considering the anticipated increase in costs when the preliminary economic and technical feasibility analyses are corrected.

Question 21: ***OSHA is asking if any federal regulations duplicate, overlap, or conflict with the proposed standard***.

Comment:
We recommend removal of the requirement in 29 CFR 1910.124 (h)(4) concerning the periodic examination of workers' skin and nostrils for chromic acid use. This surveillance requirement should be under a single requirement, such as the proposed hexavalent chromium standard. Additionally, the Team recommends removal of 29 CFR 1915.51 (d)(1)(iv) regarding control options for chromium-bearing metals, as it will be superseded by the "Methods of Compliance" section in the hexavalent chromium regulation.

The Team agrees with OSHA's assessment to reference the hazard assessment section of the Personal Protective Equipment Standard for addressing the potential for Cr (VI) eye and dermal hazards. This appears to be the best approach if some operations, such as welding, present minimal eye and dermal hazard potential with no definitive thresholds to determine what is or is not an eye or dermal hazard.

Question 22: ***In some facilities, adjustments in ventilation systems to comply with the proposed PEL may require additional time and expense to retest these systems to ensure compliance with EPA or state requirements. OSHA requests information and comments indicating how frequently retesting would be required, and the time and costs involved in such retesting.***

Comment:
While testing is often necessary where temporary flexible local exhaust ducts are used in the Maritime Industry, it is often a case of ensuring that system's components are maintained and replaced when necessary. Larger shipyards have employees dedicated to focus on these tasks on a daily basis. Regarding EPA or state requirements, the Team believes this applies to facilities that may have Pollution Control Devices (PCDs) required by a Title V permit. EPA has stringent test protocols for testing PCDs. Adjustments to a ventilation system that is part of an Air Title V permit would most likely be considered a modification requiring permit amendments, approvals, and possible retests.

Question 23: ***Submit any data, information, or comments pertaining to possible environmental impacts of adopting this proposal, such as the following: a. Any positive or negative environmental effects that could result; b. Any irreversible commitments of natural resources which could be involved; and c. Estimates of the effect of the proposed standard on the levels of Cr (VI) in the environment. In particular,***

consideration should be given to the potential direct or indirect impacts of the proposal on water and air pollution, energy use, solid waste disposal, or land use. d. Some small entity representatives noted that OSHA PELs are sometimes used to set ''fence line'' standards for air pollutants. OSHA is unable to find evidence of states formally using this procedure, though some states may use such a procedure informally.

Comment:
No information to offer.

Question 24: ***OSHA's safety and health advisory committees for Construction and Maritime advised the Agency to take into consideration the unique nature of their work environments by either setting separate standards or making accommodations for the differences in work environments in construction and Maritime. To account for differences in the workplace environment for these different sectors OSHA has proposed separate standards for general industry, construction, and shipyards. OSHA is asking if this approach is appropriate*****.**

Comment:
The Team believes OSHA has taken the correct approach in creating separate standards for general industry, construction, and shipyards. Shipyards and shipyard employment represent a unique set of working conditions and the most effective way to address those conditions is to create specific standards tailored to their needs. In fact, precedent for segregating shipyards from general industry already exists within OSHA and the Department of Labor. For example, within OSHA there is a specific "Maritime Safety Standards Office" that very effectively focuses its attention on shipyards and their unique workplace environment. OSHA has already issued a number of separate Maritime regulations in the form of vertical standards for the Maritime Industry. The Team believes that shipbuilding is a specialized industry and that the Maritime Standards Office, which is composed of specialized Safety Professionals, is best suited to address this industry.

One example of the shipyards' unique set of working conditions is ventilation, which is the primary engineering control for air contaminants in shipyards. However, the types of ventilation systems employed by shipyards to address those contaminants differ greatly from those used in general industry. Unlike those in general industry, shipyard ventilation systems must have a small footprint, be easily portable, and contain long flexible ducts to reach frequently enclosed or tight, confined spaces inside ships and units of ships. The corrugations in the flexible ducting provide structural support for the duct but at the same time considerably reduce the airflow efficiency, which leads to an overall reduction in ventilation efficiency, hence higher airborne emissions compared to a stationary assembly line ventilation system that could be used in general industry. Shipyards must balance the number of ventilation tubes on the ships with concern for the amount of congestion these tubes create in passageways, access ports, and other areas of travel. It is important to maintain these work areas on the ships in such a manner that emergency escape is unhindered. These ventilation systems are in contrast to the larger fixed systems typically found on an assembly line in a factory or in other types of general industry settings.

Another factor that sets the shipyard industry apart from all other sectors in the general industry is that the Longshore Harbor Worker's Compensation Act (LHWCA) covers shipyard employees. The Longshore and Harbor Worker's Compensation Division, a specifically designated division within the Department of Labor, administer the LHWCA. Except for longshoremen who load and unload ships and are rarely, if ever, involved in welding or other potential hexavalent chrome-generating activities, shipyard workers are the only other category of workers covered by the LHWCA. It should be noted that the LHWCA Compensation Program is the most generous program of its kind within any state or the Federal Government, including FECA, which covers all civil servants in public shipyards.

Worker's compensation costs are rapidly increasing for shipyards despite the fact that shipyards' injury and illness rates continue to decline. The Team urges OSHA to issue a separate standard for shipyards that is not only protective of employee health and safety but also reasonable and cost effective.

A final compelling reason for a separate shipyard standard relates to issues of national security. The integrity of the welds produced in shipyards is paramount to the integrity of any ship. It is crucial to have a separate shipyard standard that can address the issue of protecting employee health and safety while at the same time taking into consideration the absolute critical need for Naval vessels to have near-perfect weld quality for the shock loading requirements of their missions.

For the above-mentioned reasons, the Team believes that OSHA is correct in its proposed Rule change to establish a separate standard for shipyards.

Question 25: OSHA has not proposed to cover agriculture because the agency is not aware of significant exposures to Cr (VI) in agriculture. Is this determination correct?

Comment:
No additional information to offer.

Question 26: ***OSHA has proposed to regulate exposures to all Cr (VI) compounds. OSHA is asking if this is an appropriate determination*.**

Comment:
Although there is evidence of varied health effects and/or the carcinogenicity for specific hexavalent chromium compounds, the Team supports the implementation of a health standard based on the presence of Cr (VI) regardless of the compound. This is especially

true when workers are potentially exposed to Cr (VI) from unknown specific compounds (e.g., unknown chromated primers or surface coatings being disturbed).

Questions 27: ***OSHA has made a preliminary determination to exclude Cr (VI) exposures due to work with portland cement from the scope of the construction standard*. *Is this determination correct?***

Comment
No additional information to offer.

Question 28*: OSHA has proposed to include exposure from Cr (VI) from portland cement in the scope of the standard for general industry. Is this determination correct?*

Comment:
No additional information to offer.

Question 29: ***OSHA has proposed to exempt from coverage Cr (VI) exposures occurring in the application of pesticides in general industry (such as treatment of wood with Chromium copper arsenate (CCA)) because pesticide application is regulated by EPA . . . Is this approach appropriate? Are there any instances where EPA-regulated pesticide application occurs in construction or shipyard workplaces?***

Comment:
No additional information to offer.

Question 30*: Describe any additional industries, processes, or applications that should be exempt from the Cr (VI) standard*.

Comment:
No additional information to offer.

Question 31: ***OSHA is requesting information regarding modification of the proposed construction standard to better account for the workplace conditions in that industry. OSHA offered the application of specific controls in certain situations similar to the asbestos standard***.

Comment:
The Team does not see a benefit in offering a prescriptive approach in the application of specific controls or processes similar to the asbestos standard. Specific control methods must be fully researched to show technical and economic feasibility before being

promulgated in a Regulation. Requiring specific control methods would hamper the development and use of new technologies.

Recommendation: Do not require specific control methods or a prescriptive approach to the proposed rule.

Question 32: ***Can the proposed Cr (VI) standard for shipyards be modified in any way to better account for the workplace conditions in that industry, while still providing appropriate protection to Cr (VI)-exposed workers in that industry?***

Comment:
As explained in other responses, the proposed PEL should be set higher, in the range originally considered by OSHA, for example 5 or 10 $\mu g/m^3$.

Question 33: ***OSHA has proposed a TWA PEL for Cr (VI) of 1.0*** **$\mu g/m^3$*****. The Agency has made a preliminary determination that this is the lowest level that is both technologically and economically feasible and is necessary to reduce significant risks of material health impairment from exposure to Cr (VI). Is this PEL appropriate and is it adequately supported by the existing data? If not, what PEL would be more appropriate or would more adequately protect employees from Cr (VI)- associated health risks?***

Comment:

OSHA's economic and technological feasibility analyses contain significant errors. As discussed in the response to Question 15, the Team concludes that when these analyses are corrected, meeting the PEL will likely be cost-prohibitive as well as impractical. A higher PEL, i.e., 5 or 10 $\mu g/m^3$ in the original range considered by OSHA in 1995, would be much more feasible. These conclusions are supported in responses to questions contained herein, (Ref. (1)) and by the NSRP/SHAC Report referenced in the response to Question 15.

Question 34: ***OSHA is requesting information regarding whether different permissible exposure limits (PELs) for different hexavalent chromium compounds should be established.***

Comment:
See response to Question 26.

Question 35: ***OSHA is asking if not having an action level in the proposed construction and Maritime standard is appropriate.***

Comment:

The Team agrees with OSHA's approach in not having an action level in the proposed construction and Maritime standards. The Navy basically conducts maintenance and repair tasks vice production level work. Variability in day-to-day operations makes the usefulness of the action level in maritime operations questionable since monitoring results would still not be available until after the operations have been completed.

Question 36: ***If an action level is included in the final rule, is the proposed action level for general industry (0.5 ug/m3) the appropriate level for the PEL under consideration? If not, at what level should the action level be set?***

Comment:
See response to Question 35.

Question 37: ***If an action level is included in the final rule, which provisions should be triggered by exposure above the action level? Indicate the basis for your position and include any supporting information***.

Comment:
See response to Question 35.

Question 38: ***If no action level is included in the final rule, which provisions should apply to all Cr (VI)-exposed workers? Which provisions should be triggered by the PEL? Are there any other appropriate triggers for the requirements of the standard?***

Comment:
The Team supports the proposed provisions triggered by exposures at or above the permissible exposure limit (PEL) presented in the Maritime Standard.

We concur that OSHA has provided requirements at the appropriate triggers, such as personal protective equipment for dermal and eye protection where a hazard exists due to contact of the skin or eyes with hexavalent chromium, as opposed to arbitrarily setting that requirement at an airborne exposure level. It is prudent to conduct training for personnel who potentially could be exposed below the PEL to ensure that they utilize the proper controls so that their operation remains below the PEL.

Question 39: ***OSHA is requesting information regarding the need to set a short-term exposure limit (STEL) or a ceiling standard.***

Comment:
A STEL or a ceiling standard for Cr (VI) is not appropriate where the health impairment is based on a working lifetime exposure and the established TWA permissible exposure limit is protective for acute effects. For example, a single 15-minute exposure of one half

of the current ceiling standard would still be under the proposed 8 hour TWA permissible exposure limit.

Recommendation: OSHA should not promulgate a STEL or a ceiling limit for Cr (VI).

Question 40: ***Do you conduct initial air monitoring or do you rely on objective data to determine Cr (VI) exposures? Describe any other approaches you have implemented for assessing an employee's initial response to determine Cr (VI) exposures? Describe any other approaches you have implemented for assessing an employee's initial exposure to Cr (VI).***

Comment:
As a Navy-wide practice, initial and follow-up air monitoring is conducted to support the assessment of worker exposures based on similar exposure groups using the "Industrial Hygiene Field Operations Manual," NEHC-TM 6290-91-2, Rev. B, Navy Environmental Health Center, Feb 1999, http://www-nehc.med.navy.mil/ih/ihfom99.htm, and "A Strategy for Assessing and Managing Occupational Exposures," American Industrial Hygiene Association, 1998, for the specific operation being performed. Similar practices are used in the major private shipyards.

Recommendation: The Team desires that exposure assessments be based on the best determined refinement of the elements of a unique similar exposure group description. This is the desired approach for determining needed controls and medical surveillance because exposures are based mainly on the operation and not the job category.

OSHA discussed the employer's choice not to sample based on assuming that exposures are either clearly greater or less than the PEL. Such determinations can be made using previous sampling. However, there may be many cases where the exposure profile is not clearly over or under the PEL and periodic sampling is desired to justify reducing control requirements. Therefore, periodic exposure assessments would be conducted and would present a cost to the employer.

Question 41: ***Describe any follow-up or subsequent exposure assessment that you conduct. How often do you conduct such follow-up or subsequent exposure assessments? Please comment on OSHA's estimate of baseline industry practice and the projected costs for initial and periodic exposure assessment. Are OSHA's estimates consistent with current industry practice?***

Comment:
Shipyards conduct follow-up air monitoring to evaluate existing engineering controls or to evaluate changes in working conditions. As a specific related example, one major shipyard has collected more than 100 follow-up samples for Cr (VI) since 1991. Since 1995, sampling for Cr (VI) has been conducted each year. Most of these samples have been collected on welders. The actual cost of initial air sampling for Cr (VI) at this

private shipyard was $5,526, and the cost of follow-up sampling was $17,783. Employee exposures to Cr (VI) are comprehensively evaluated.

Question 42: ***Do shipyard employers presently measure their employees' exposure to Cr (VI)? If not, do they use some alternative method of identifying which employee may be overexposed to Cr (VI)?***

Comment:
Major shipyards presently measure their employees' exposure to Cr (VI) utilizing OSHA's Method ID-215.

Question 43: ***OSHA is specifically inquiring as to the appropriateness for the exposure assessment requirements in the general industry standard that are not present in the proposed construction and Maritime standards. Would construction or shipyard employees encounter situations where monitoring would be infeasible if they were required to follow the exposure assessment requirements proposed for general industry? What types of exposure assessment strategies are effective for assessing worker exposures at construction and shipyard work sites?***

Comment:
OSHA has previously promulgated prescriptive and more stringent exposure standards for the construction industry without monitoring (e.g., "task-based" triggers). Navy shipyard employees are generally less nomadic and conduct operations under documented process controls. Shipyards understand the need to monitor in order to anticipate the exposure potentials for various job tasks. This ensures that shipyard workers are adequately protected (performance-based approach). This follows the business practice discussed in the response to Question 40.

The Team supports the performance-based approach. However, the employer should be allowed to determine when to sample, i.e., when conditions change. PELs should not be triggers for schedules for periodic monitoring, as this can become unnecessarily expensive if conditions do not change in the job.

The prescriptive schedule of required air sampling has not proved beneficial in assessing risks in shipyards. This has been noted with job tasks where there has been virtually no change in conditions, yet costs for consistent air sampling have been incurred on an annual basis without informational benefit or added protection for workers. The performance-based sampling approach in the proposed standard for construction and shipyards is protective, efficient, and logical.

Recommendation: The Team supports a performance-based standard.

Question 44: ***OSHA is asking if the requirements for the general industry should be similar to the performance-oriented requirements of the proposed construction and Maritime standards*.**

Comment:
The Navy's business practice per its Navy's "Industrial Hygiene Field Operations Manual," NEHC-TM 6290-91-2, Rev. B, Navy Environmental Health Center, Feb 1999, http://www-nehc.med.navy.mil/ih/ihfom99.htm; and the text "A Strategy for Assessing and Managing Occupational Exposures," American Industrial Hygiene Association, 1998 along with the responses to Questions 40 through 43 support a standard that is performance-based.

Recommendation: The Team supports a performance-based standard.

Question 45: ***OSHA has proposed that exposure monitoring in general industry be conducted at least every six months if exposures are above the action level but below the PEL, and at least every three months if exposures are at or above the PEL. Are these proposed frequencies appropriate? If not, what frequency of monitoring would be more appropriate, and why?***

Comment:
See response to Question 43.

Question 46: ***OSHA has proposed that regulated areas be established in general industry wherever an employee's exposure to airborne concentrations of Cr (VI) is, or can reasonably be expected to be, in excess of the PEL. OSHA seeks comments on this provision and in particular: a. Describe any work settings where establishing regulated areas could be problematic or infeasible. If establishing regulated areas is problematic, what approaches might be used to warn employees in such work settings of high-risk areas (i.e., areas where the airborne concentrations of Cr (VI) exceed the PEL?). b. Should OSHA add hazards from eye or skin contact as a trigger for establishing regulated areas? Explain the basis for your position, and include any supporting information. c. Describe any methods currently used that have been found to be effective in establishing regulated areas.***

Comment:
a. The decision to designate regulated areas should be left to the employer performing the risk assessment on a case-by-case basis. Signs and other means of warning employees of the potential for overexposure may be used as well, but should be left to the professional judgment of the employer, whose ultimate responsibility is to ensure that employees are protected. This provision fits with the concept of performance-based rulemaking.

b. No. Given the lack of definitive threshold information for what is clearly considered an "overexposure" for eye or skin contact, OSHA should limit triggers for establishing regulated areas to “where a hazard is present”. The ability to apply risk assessments and professional judgment are the most effective methods proven useful to determine work areas where there would be a definite potential for eye or dermal contact hazard, such as in chromic acid etching and chrome electroplating.

c. The most appropriate current means of establishing a regulated area is through the process of air sampling and professional assessments for eye and skin hazards, which is consistent with performance-based rulemaking.

Question 47: ***OSHA has not proposed requirements for establishment of regulated areas in construction or shipyards. Should requirements for regulated areas for construction or shipyards be included in the final Cr (VI) standard? If so, would the requirements for regulated areas proposed for general industry be appropriate? Are there any particular problems in construction or shipyard settings that make regulated areas problematic or infeasible?***

Comment:
Maritime regulated areas should not be required in the final Standard. Establishing regulated areas in the Maritime Industry would present logistic problems given the configurations of the various types of work areas and the presence of multiple trades within those spaces. On board ships and in ship modules, access becomes a problem. Because of the small size of shipboard areas —passageways in particular—it would be unnecessary, and in some cases hazardous, to restrict access to personnel in areas where low-risk operations are being conducted. In addition, the process of building a vessel section continually moves from station to station throughout manufacturing areas. The logistics of regulating these areas as a moving process would be impractical. The decision to apply regulated areas should be left to the employer performing the risk assessment on a case-by-case basis. Signs and other means of warning employees of the potential for overexposure may be used where operations meet or exceed the PEL. This approach is consistent with the concept of performance-based rulemaking.

Question 48: ***Under the proposed standard, employers are required to use engineering and work practice controls to reduce and maintain employee exposure to Cr (VI) to or below the PEL unless the employer can demonstrate that employees are not exposed above the PEL for 30 or more days per year, or the employer can demonstrate that such controls are not feasible. Is this approach appropriate for Cr (VI)?***

Comment:
This 30-day threshold approach reflects the reality and challenges of the Maritime Industry and has value in the shipbuilding and repair industry. The concept allows employers to focus engineering and work practice controls on those operations having the potential to result in the greatest cumulative exposure while providing the flexibility to address lower-exposure operations based on a hazard assessment approach.

As explained in the responses to Questions 15 and 16, given the nature of the worksite there are instances in the Maritime Industry when it is not feasible to use the most preferred engineering controls. At that point it is necessary for the employer to define the risks and implement alternatives that provide adequate protection. It is important that this provision be maintained in the regulations.

Question 49: ***OSHA is inquiring if separate engineering control air limits (SECALS) should be established***.

Comment:
The Team does not believe the establishment of a SECAL is necessary. For some operations, such as SMAW on chromium alloyed steels, engineering and work practice controls alone are not sufficient to reduce airborne exposures to below the PEL and respiratory protection is required to reduce exposures below the PEL. Respiratory protection is utilized when engineering and work practice controls are not effective in maintaining exposures below the PEL.

Question 50: ***The proposed standard prohibits the use of job rotation for the sole purpose of lowering employee exposures to Cr (VI). Are there any circumstances where this practice should be allowed in order to meet the proposed PEL?***

Comment:
No information to offer.

Question 51 – ***OSHA is expecting an employer to exercise common sense and appropriate expertise to determine if a hazard is present. OSHA is also asking for methods to measure dermal exposure that could be used to routinely monitor worker exposure to hexavalent chromium.***

Comment:
Employers should provide protective clothing when a hazard is present or is likely to be present from skin or eye contact. Worksites should be evaluated no differently than what is currently done under the requirements under Subpart I (29 CFR 1915.152, 153 and .157; also 29 CFR 1910.132 and .133). Because a removable surface contamination level for occupational exposure does not exist, a small amount of surface contamination does not mean a dermal or eye hazard exists. Different hexavalent chromium containing materials (e.g., chromic acid or Cr (VI) welding fumes) present different dermal risks. Chromic acid is a known dermal hazard for electroplaters. However, hexavalent chromium in welding fume is not believed to pose a dermal hazard. It is appropriate to expect an employer to exercise common sense and appropriate expertise to determine if a hazard is present or likely to be present. We support OSHA's approach of expecting the employer to utilize appropriate expertise in determining the need for protective clothing.

Recommendation: The Team agrees with OSHA's approach. Current requirements are already in place to protect workers from dermal hazards.

Questions 52*: OSHA is asking employers on what approaches to assess potential hazards from eye and skin contact. Also, OSHA is inquiring should protective clothing and equipment be used for employees exposed to concentration of Cr (VI) in excess of the PEL.*

Comment:
Regarding eye and skin contact, current requirements are already in place to protect workers from dermal hazards under Subpart I (29 CFR 1915.152, 153 and .157; also 29 CFR 1910.132 and .133). Selection of appropriate protective clothing/equipment would be based on the physical and chemical properties of the material in the workplace regardless of the presence of Cr (VI).

As with other potential health hazards in the workplace, shipyards perform health hazard assessments. Important aspects to a hazard assessment include the measurement of airborne Cr (VI), an understanding of how employees come into contact with Cr (VI), knowledge of the specific Cr (VI) compound(s) and an investigation of scientific literature to determine if the compound presents a significant dermal or eye hazard. If it does present a significant hazard, the appropriate PPE would be specified.

There is no historical medical information in shipyard records to suggest that there are eye or dermal hazards experienced by shipyard hot workers, painters, or paint removal personnel that can be directly attributable to Cr (VI). Protective clothing may be appropriate for certain operations such as chrome electroplating and chromic acid etching on pipes, where some type of chemical protective apron, gloves, and boots may be necessary. However, the Maritime Industry is concerned about the impact on welding operations and any protective clothing requirements that go beyond that of standard welding. The industry would question the existence of a Cr (VI) eye and dermal hazard under these circumstances.

Currently, shipyards provide chemical protective gloves, chemical protective aprons and a face shield to employees who conduct chrome electroplating and chromic acid etching on pipes. The annual cost of these items is approximately $710 per employee. For welding operations, shipyards provide no protective clothing or equipment beyond what is generally required for welding operations (respiratory protection for certain jobs, welding helmets, leather gloves, etc).

Question 53*: Should OSHA require the use of protective clothing and equipment for those employees who are exposed to airborne concentrations of Cr (VI) in excess of the PEL? If so, what type of protective clothing and equipment might be necessary?*

Comment:

Other than respiratory protection, the Team agrees with OSHA's Proposed Rulemaking that PPE should not automatically be required when personnel are exposed above the PEL. PPE should be specified when an employer's hazard assessment determines that an eye or dermal hazard exists. In shipbuilding and repair, many of the interfaces with Cr (VI) involve hot work, such as welding, and PPE prescribed for welding results in the skin and eyes being protected.

Question 54: ***OSHA has proposed to require that employers pay for protective clothing and equipment provided to employees. a. Should OSHA refrain from requiring employer payment, and follow the outcome of the rulemaking addressing employer payment for personal protective equipment? b. Are there circumstances where employers should not be required to pay for clothing and equipment used to protect employees from Cr (VI) hazards?***

Comment:
The Team recommends that OSHA refrain from requiring employer payment and following the outcome of the rulemaking addressing employer payment for PPE.

Questions 55: ***OSHA is proposing that washing facilities capable of removing Cr (VI) from the skin be provided to affected employees, but does not propose that showers be required. Should OSHA include requirements to provide showers to employees exposed to Cr (VI)?***

Comment:
OSHA should continue to stipulate that showers not be required. There is no historical medical information to suggest that there are eye and dermal hazards experienced by shipyard hot workers, painters and paint removal personnel that can be directly attributable to Cr (VI).

Question 56: ***OSHA is asking the appropriateness of not including housekeeping provisions in the construction and shipyard standards and inquiring in what practicable measures employers can take.***

Comment:
The Team agrees with OSHA that requirements for housekeeping activities should be performance-oriented, as it is for other aspects of the proposed regulation. For example, liquid hexavalent chromium compounds and other chemicals that contain percentages of hexavalent chromium should be cleaned up to meet best management practices. Material such as dried paint residue containing chromates should be cleaned up sufficiently to meet best management practices for control of paint removal activities as required by environmental regulations. However, for welding and other hot work operations where the hexavalent chromium does not present a hazard to eyes or skin, additional housekeeping procedures would not be necessary.

Questions 57: ***Is medical surveillance being provided to Cr (VI)-exposed employees at your worksite? If so, a. What exposure levels or other factors trigger medical surveillance? b. What tests or evaluations are included in the medical surveillance program? c. What benefits have been achieved from the medical surveillance program? d. What are the costs of the medical surveillance program? How do your current costs compare with OSHA's estimated unit costs for the physical examination and employee time involved in the medical surveillance program?***

Comment:
a. According to the Navy's Medical Surveillance Procedure Manual and Medical Matrix (Edition 7), NEHC-TM OM 6260 (February 2001), workers with potential exposure to hazards are usually placed in medical surveillance programs based on industrial hygiene (IH) surveys that quantify exposures in the workplace. The decision to include a worker in a program is normally based on the possibility of exposure at or above a level set by Navy standards that must comply with Occupational Safety and Health Administration (OSHA) standards. Workers whose jobs are associated with exposures to hazards at or above the medical surveillance level for more than 30 days per year or 15 days per quarter are placed in medical surveillance programs. Shipyards anticipate establishing a medical surveillance program/criteria for personnel who, by nature of their work assignments, are identified via the hazard assessment process as qualifying for medical surveillance.

b. From the Navy's Medical Surveillance Procedure Manual and Medical Matrix (Edition 7), NEHC-TM OM 6260 (February 2001), the following tests are recommended:

ANNUAL:
-History & Physical
-CBC with differential
-BUN
-Creatinine
-SGOT (AST)
-Urinalysis with microscopic
 spirometry

FOR BASELINE AND TERMINATION:
-Liver profile
-Chest X-ray (PA)

As part of a medical examination, medical professionals administer question that address the skin, eyes and other potential Cr (VI) target organs/systems.

c. No information to offer.

d. Cr (VI**)** cost of medical surveillance at shipyards tracks closely to the data on Table IX-14. The Team agrees that the full cost of a comprehensive medical exam is in the range of $250 to $300. Additional testing, such as a urinary heavy metal screen with analysis of chromium, would cost an additional $100 to $150. The Team agrees that the cost quoted for a medical history questionnaire, medical exam for respirator use, and a partial medical exam, is consistent with our experience. In the cost analysis, OSHA does not address the employee's time off the job where the employee is being paid full wages to participate in surveillance; yet, there are associated production losses. In the shipbuilding industry, this cost would be substantial when multiple work classifications (welders, pipe fitters, cleaners, shop fitters, etc) are involved in a surveillance program.

Question 58: ***OSHA has proposed that medical surveillance be triggered in general industry in the following circumstances: (1) When exposure to Cr (VI) is above the PEL for 30 days or more per year; (2) after an employee experiences signs or symptoms of the adverse health effects associated with Cr (VI) exposure (e.g., dermatitis, asthma); or (3) after exposure in an emergency. OSHA seeks comments as to whether or not these are appropriate triggers for offering medical surveillance and whether there are additional triggers that should be included. Should OSHA require that medical surveillance be triggered in general industry only upon an employee experiencing signs and symptoms of disease or after exposure in an emergency, as in the construction and Maritime standards? OSHA also solicits comment on the optimal frequency of medical surveillance.***

Comment:
From a medical standpoint, triggering requirements should be consistent across all industries. Also, who would be the party responsible for detecting signs of Cr (VI) exposure?

Question 59*: OSHA has proposed that medical surveillance be triggered in construction and shipyards in the following circumstances: (1) after an employee experiences signs or symptoms of the adverse health effects associated with Cr (VI) exposure (e.g., dermatitis, asthma) or (2) after exposure in an emergency. Should medical surveillance in construction or shipyards be triggered by exposure to Cr (VI) above the PEL for 30 days or more per year, as proposed for general industry? OSHA seeks comments as to whether or not the proposed triggers are appropriate for offering medical surveillance and whether there are additional triggers that should be included.*

Comment:
Shipyards agree with OSHA’s Proposed Rulemaking for the Maritime Standard that the triggers included are appropriate. Additionally, shipyards will utilize hazard assessments to identify personnel they believe warrant medical surveillance for Cr (VI). The Team has some difficulty with “adverse health effects” that can be alleged, such as gastrointestinal symptoms that are commonplace and may not be related to chromium exposure. OSHA

should narrowly define which "adverse health effects" would result in medical surveillance.

Question 60: ***OSHA has not included certain biological tests (e.g., blood or urine monitoring, skin patch testing for sensitization, expiratory flow measurements for airway restriction) as a part of the medical evaluations required to be provided to employees offered medical surveillance under the proposed standard. OSHA has preliminarily determined that the general application of these tests is of uncertain value as an early indicator of potential Cr (VI)-related health effects. However, the proposed standard does allow for the provision of any tests (which could include urine or blood tests) that are deemed necessary by the physician or other licensed health care professional. Are there any tests (e.g., urine tests, blood tests, skin patch tests, airway flow measurements, or others) that should be included under the proposed standard's medical surveillance provisions? If there are any that should be included, explain the rationale for their inclusion, including the benefit to worker health they might provide, their utility and ease of use in an occupational health surveillance program, and associated costs.***

Comment:
The Team agrees with OSHA's Proposed Rulemaking not to include certain biological tests due to the uncertainty of their efficacy. The Standard allows the examining health care professional to determine the most appropriate medical surveillance to be administered.

The Team is unaware of any specific medical tests for Cr (VI) that would be beneficial.

Question 61: ***OSHA has not included requirements for medical removal protection (MRP) in the proposed standard. OSHA has made a preliminary determination that there are few instances where temporary worker removal and MRP will be useful. The Agency seeks comment as to whether the final Cr (VI) standard should include provisions for the temporary removal and extension of MRP benefits to employees with certain Cr (VI)-related health conditions. In particular, what endpoints should be considered for temporary removal and for what maximum amount of time should MRP benefits be extended? OSHA also seeks information on whether or not MRP is currently being used by employers with Cr (VI)-exposed workers, and the costs of such programs.***

Comment:
The Team agrees with OSHA's Proposed Rulemaking for shipyards not to include medical removal protection (MRP). Unlike the lead standard, where a biological test, namely, lead in blood, can be administered to status an employee's biological condition, there is no such biological test available for Cr (VI). As identified in the Question, what endpoint would be used to determine if an employee were cleared to return to work?

It is unclear what would be the trigger for medical removal, given that serum and urinary tests for chromium are variable and not representative of body burden. (For example, 80% of chromium is excreted within 48 hours of exposure). We would agree that individuals who are sensitized (asthma, dermatitis) should be removed from the chromium environment. These are likely to be removed on a permanent basis, not temporarily.

Question 62: ***OSHA has proposed that employers provide hazard information to employees in accordance with the Agency's Hazard Communication standard (29 CFR 1910.1200) and has also proposed additional requirements regarding signs, labels, and additional training specific to work with Cr (VI). Should OSHA include these additional requirements in the final rule, or are the requirements of the Hazard Communication standard sufficient?***

Comment:
Referring to section (i) (3) of the proposed Standard, the industry seeks definition with regard to the proposed provision to train "all employees who are potentially exposed to chromium (VI)". If this were to be amended with "at or above the PEL", it would be possible for the industry to determine the levels of training to be provided for the various exposure groups. One approach may involve providing lower risk employees (below the PEL) with HazCom training and higher risk employees with regulatory-specific training that addresses the proposed requirements in (i) (3) (iii) A through I.

The Hazard Communication standard can appropriately address requirements for signs and labels.

Question 63: ***OSHA has proposed that bags or containers of laundry contaminated with Cr (VI) bear warning labels. Will this cause you to alter your current laundry practices? Are there laundries in your area that would accept such laundry? Would laundering costs increase?***

Comment:
Yes, labeling bags or containers of Cr (VI)-contaminated laundry would be a change for shipyards. It is unknown if there are laundries in the area of the shipyards that would accept such laundry. Such laundering of Cr (VI)-contaminated laundry would increase costs. Shipyards do not know how much this cost increase would be.

Question 64: ***OSHA is inquiring information regarding the time allowed for compliance with the provisions of the proposed standard.***

Comment:
The Team recommends that 29 CFR 1915.1026 (k)(l)&(2) be modified from 90 days to one year to allow for the development and implementation of work procedures,

development and delivery of training, acquisition of additional respiratory protection and additional exposure monitoring. Paragraph (k)(2)(i) and (ii) is recommended to stay as is.

Question 65: ***OSHA is requesting information regarding advantages or disadvantages for the lack of Appendices as usually present in other OSHA health standards*****.**

Comment:
The Team agrees that guidance documents will serve as useful tools in assisting employers, particularly smaller employers, with compliance with the standard.

III. General Recommendations/Conclusions

1. The Team supports OSHA's decision to take into consideration in the Proposed Standard the unique nature of shipyard work environments by proposing a separate Maritime Standard. Further, The Team supports the proposed Maritime Standard that utilizes performance-based concepts. Performance-based concepts are the most effective approach to protecting the worker in the shipyard's unique work environment and at the same time are the most cost-effective approach. Support for the proposed Standard is reflected in responses to numerous questions throughout Section III, and Question 24 in particular.

2. OSHA's feasibility analysis is incorrect in concluding that shipyards will be able to meet the PEL of 1 $\mu g/m^3$ in the foreseeable future using currently available engineering controls and work practices along with described new technological developments. Due to the nature of the shipbuilding and repair environment, it will not be possible to meet the PEL of 1 $\mu g/m^3$ using only engineering, work practice controls and new technological developments in welding, cutting and burning processes on stainless steel and other high-chrome alloys and some other processes in certain confined and enclosed areas. In these circumstances, respirators would be required to meet the PEL of 1 $\mu g/m^3$. Additionally, shipyards believe they will be unable to implement engineering and work practice controls, along with any technological developments, to achieve the proposed PEL in these areas within OSHA's two-year time frame. This is discussed in several responses to Questions in Section III and Question 15 in particular.

Considering the above, OSHA should correct its feasibility analysis and increase the proposed PEL to the range originally considered by OSHA of 5 or 10 $\mu g/m^3$.

3. OSHA's preliminary economic analysis greatly underestimates the impact on the Maritime Industry. It underestimates the number of potentially affected personnel and, therefore, the overall cost impact to the Maritime Industry in terms of training, engineering controls, exposure assessments, respiratory protection and other personal protective equipment. The economic analysis should be corrected to reflect the correct number of affected shipyard personnel in all areas of the analysis. This error in the economic analysis is discussed in several responses to the Questions in Section III and Question 10 in particular.

Considering the above, in its final economic analysis OSHA should correct its underestimation of the number of potentially affected personnel and the overall cost impact to the Maritime Industry.

4. Considering the anticipated significantly higher costs when OSHA's corrects its economic and technological feasibility analyses based on the findings hereinabove, the Team concludes that meeting the PEL will be proven to be cost-prohibitive as well as impractical. A higher PEL, i.e., 5 or 10 $\mu g/m^3$ in the original range considered by OSHA in 1995 would be significantly more feasible.

IV. Attachments

Attachment 1: Information on Navy Team and List of Members
Attachment 2: Navy/Industry Reports in OSHA Docket H054-A
Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003
Attachment 4: Response to Issues (Section II Questions) – Naval Air Community

Attachment 1: Information on Navy Team and List of Members

In order to evaluate the Occupational Health and Safety Administration's (OSHA) Proposed Rule for airborne emissions of hexavalent chrome (Cr (VI)), NAVSEA re-established the Navy Task Group (hereinafter "Team) on Airborne Cr (VI) Emissions. This Team was originally established in 1995, when OSHA first announced its plan to issue a new standard for occupational exposure to Cr (VI). The Team subsequently prepared a report on the impact on Naval shipbuilding of the proposed Cr (VI) Permissible Exposure Limit (PEL) in the range of 0.5 to 10 $\mu g/m^3$, which OSHA was considering. This report was first forwarded and then presented to OSHA in November 1995 by Team representatives. Until 2002, the Team remained active in discussions with OSHA and in Navy and the National Shipbuilding Research Program (NSRP) projects to further define the impact of the proposed Cr (VI) standard, and research and development projects on new techniques or equipment to reduce Cr (VI) exposure to the worker.

Between 1995 and 2002, the Navy and the Maritime Industry actively pursued efforts to reduce Cr (VI) airborne emissions exposure to the worker in shipyards and repair facilities. These reports from the Navy and NSRP are included on Docket HO54A for this proposed rule change and are listed in Attachment (2). OSHA referenced these reports extensively in its analysis to support the proposed rulemaking.

This Team includes personnel from the major shipyards, Naval Sea Systems Command, Naval Air Systems Command, Navy Bureau of Medicine and Surgery/Navy Environmental Health Center, technical support organizations, shipbuilding trade associations, and others. Included in this group are those health and safety professionals who are responsible for, or provide technical support to those ensuring the safety and health of personnel in shipyards and repair/overhaul facilities. Members of this group represent the key technical personnel responsible for executing OSHA requirements in the shipyards and have been involved in evaluations of the impact of this proposed standard and research and development to reduce Cr (VI) airborne exposure to shipyard personnel. Thus, the most knowledgeable key personnel concerning Cr (VI) airborne exposure in shipyards are participating in this Team.

Members of the Team met on October 21, 2004 in the Washington, DC area and on December 6-7, 2004 in Norfolk, VA, where they also participated in discussions at the meetings of National Shipbuilding Research Program and Safety and Health Advisory Committee. At these meetings, the responses to OSHA's 65 Questions in Section II of the Preamble to the Proposed Cr (VI) Standard and other comments were developed based on input provided by participants. The responses to OSHA's 65 questions and other comments on the proposed standard represent a consensus of the Team**.**

Navy Team

The following organizations participated in and contributed to this report:

Navy Members

Naval Sea Systems Command Representative and Team Leader– Charles L. Null, 828-625-9659, fuelline@bellsouth.net.
Navy Environmental Health Center – John Bishop, 757-688-4002, bishopj@nehc.med.navy.mil.
Naval Sea Systems Command - Richard Fox, 202-781-6121, foxrf@navsea.navy.mil; Albert Grubowski, 202-781-3663 grubowski@navsea.navy.mil; Brian McCaffrey, 202-781-1925, ccaffreybe@navsea.navy.mil; David Cartwright, 202-781-1183, CartwrightDA@navsea.navy.mil.
Norfolk Naval Shipyard – Chuck Boyd, 757-396-4557, boydct@nnsy.navy.mil; A. B. Foytik, 757-396-3490, foytikAB@nnsy.navy.mil.
Naval Facilities Engineering Service Center – Trinh Do, 703-868-2582, dotn@nfesc.navy.mil; Paul McDaniel, 805-982-2640, paul.mcdaniel@navy.mil.
Naval Air Systems Command – Kenneth E. Pettersen, 301-757-2133, kenneth.pettersen@navy.mil
Office of Chief of Naval Operations (N09FB)/Naval Safety Center – Joy Erdman, 703-602-2575, mailto:Joy.erdman@navy.mil; Gavin Burdge (contractor), 703-920-7070, mailto:gavin.burdge@navy.mil.

Contributors

.
General Dynamics Electric Boat – Paul Bureau, 860-433-4771, pbureau@ebmail.gdeb.com; Kurt Cramer, 860-433-5650, kcramer@ebmail.gdeb.com.
Bath Iron Works – Dan Nadeau, 207-442-4423, dan.nadeau@biw.com; Robert Knowles, 207-442-1646, Robert.Knowles@biw.com.
Northup Grumman Newport News – Kent Shoemaker, 757-688-4002, kent.shoemaker@ngc.com.
Alabama Shipyard - Teresa Preston, 251-690-4862, tpreston@atlanticmarine.com.
Collier Shannon – Kristina Nelson, 202-342-8824, knelson@colliershannon.com; Kate McMahon, 202-342-8419, kmcmahon@colliershannon.com.
Shipbuilders Council of America – Daniel Youhas, 202-347-5462, dyouhas@dc.bjllp.com.
American Shipbuilding Assn. – Frank Losey, 202-544-8170, losey@bci-dc.com.
National Steel and Shipbuilding Company – Bob Watson, 619-544-8697, bwatson@nassco.com.
Navy Joining Center – Harvey Castner, 614-688-5063, Harvey_Castner@ewi.org.
Perot Systems – Richard Mandez, 703-933-8290, Richard.Mendez@ps.net.
University of New Orleans – Bhaskar Kura, 504-280-6572, bkura@uno.edu.
Jeffboat – Stephen Morry, 812-288-1741, serve.morris@acbl.net.

ATTACHMENT 2

Navy/Industry Reports in OSHA Docket H054-A

Exhibit	Report Title	Source
31-8-1	Additional Information On Hexavalent Chromium In Navy Workplaces: Addendum To The Original Report To OSHA	Requests For Information (Rfi) And (Sec 610 Reviews) Comments/Late Comments
31-8-3	Impact Of Proposed OSHA Hexavalent Chromium Worker Exposure Standard On Navy Manufacturing And Repair Operations	The original Navy/Industry Task Group Report, October 13, 1995 (note this same report was released as NSRP Report 0463 and is exhibit 35-419)
35-419	Impact Of Recent And Anticipated Changes In Airborne Emission Exposure Limits On Shipyard Workers	NSRP Report 0463, March 1996. The Navy/Industry Task Group Report published by NSRP. (same content as
31-8-2	The National Shipbuilding Research Program. Welding Fume Study Final Report. NSRP 7-96-9	NSRP Report 0525 January 1999
35-410	Estimated Relative Costs Of Engineering Controls To Reduce Exposure To Manganese And Hexavalent Chromium.	NSRP ASE Project - Reduction Of Worker Exposure And Environmental Release Of Welding Emissions. Technology Investment Agreement No 20000922
35-411	Final Report On Reduction Of Worker Exposure And Environmental Release Of Welding Emissions	Same as above.
35-412	Selection Of Materials To Minimize Welding Emissions From Manganese Nickel And Chromium - Revision 1	Same as above.
35-413	Task 1- Current Shipyard Practice. NSRP ASE Project. Reduction Of Worker Exposure And Environmental Release Of Welding Emissions	Same as above.
35-414	Mechanization And Automation Of Welding And Cutting Processes To Reduce Fume Exposure. Revision 1.	Same as above.

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003
Time-Weighted Average Exposures

ID: 385 UIC: COMMAND: SHOP: MAINTENANCE SAMPLE DATE: 10/9/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-04 Abrasive Blast, Sand	ABRASIVE BLASTING	1440 /BLASTING BOOTH	/ Supplied Air Helmet Continuous Flow without Escape	COPPER SLAG /	50	0.003 MG/M3

TWA: 0.0003

Based on a total time of 50 minutes.

ID: 6244 UIC: COMMAND: SHOP: 26-D5 SAMPLE DATE: 1/28/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-011-08 Welding, Shielded Metal Arc (SMAW/Stick)	SMAW ON MILD STEEL	B-171 /SHAFT-OPEN SHOP/BLDG. 171	84A-0454 / Air Purifying Half Face N95	8018 C3 ROD / MILD STEEL SHAFT	104	<0.00009 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-011-08 Welding, Shielded Metal Arc (SMAW/Stick)	SMAW ON MILD STEEL	B-171 /SHAFT-OPEN SHOP/BLDG. 171	84A-0454 / Air Purifying Half Face N95	8018 C3 ROD / MILD STEEL SHAFT	132	<0.00007 MG/M3

TWA: 0.00003

Based on a total time of 236 minutes.

ID: 6454 UIC: COMMAND: SHOP: 11-G3 SAMPLE DATE: 1/29/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-011-16 Hot Work Helper/Firewatch	GRIND/ASST X26 ON CRES	B-163 /NUCLEAR FABRICATION AREA	84A-0185 / Air Purifying Full Face Organic Vapor with P100	STAINLESS STEEL /	310	0.0076 MG/M3

TWA: 0.00499

Based on a total time of 315 minutes.

ID: 6460 UIC: COMMAND: SHOP: 26-D3 SAMPLE DATE: 1/29/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-013-00 Cutting, Multiple Operations	PLASMA CUTTING/SMAW	B-163 /BLDG. 163/NUC FAB CAGE	21C-155 / Air Purifying Full Face P100	308L-15 RODS /	317	0.037 MG/M3

TWA: 0.0248

Based on a total time of 317 minutes.

ID: 6721 UIC: COMMAND: SHOP: 26-D3 SAMPLE DATE: 1/30/2003

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003

Time-Weighted Average Exposures

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-011-08 Welding, Shielded Metal Arc (SMAW/Stick)	SMAW ON STAINLESS	B-163 /NUCLEAR FAB CAGE/BLDG.163	84A-0118 / Air Purifying Full Face P100	STAINLESS STEEL / 308L-15 ROD,1/8" DIA.	170	0.00084 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-011-08 Welding, Shielded Metal Arc (SMAW/Stick)	SMAW ON STAINLESS	B-163 /NUCLEAR FAB CAGE/BLDG.163	84A-0118 / Air Purifying Full Face P100	STAINLESS STEEL / 308L-15 ROD,1/8" DIA.	150	0.00243 MG/M3

TWA: 0.00106

Based on a total time of 320 minutes.

ID: 7790 UIC: COMMAND: SHOP: 12C SAMPLE DATE: 10/1/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING	200 /HANGAR	84A-0183 / Air Purifying Half Face Organic Vapor with P100	VIBRATING SANDER / ANGLE GRINDER	160	<0.00012 MG/M3

TWA: 0.00003

Based on a total time of 160 minutes.

ID: 10182 UIC: COMMAND: SHOP: 11-G1. SAMPLE DATE: 10/25/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-011-16 Hot Work Helper/Firewatch	PLASMA CUT ST. STEEL	S-SSN-756 /USS SCRANTON / U/L ENG RM	84A-0185 / Air Purifying Full Face Organic Vapor with P100	/	115	<0.00009 MG/M3

TWA: 0.00002

Based on a total time of 115 minutes.

ID: 10183 UIC: COMMAND: SHOP: 26-D2 SAMPLE DATE: 10/25/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-013-07 Plasma Cutting	PLASMA CUT STAINLESS	S-SSN-756 /USS SCRANTON / U/L ENG RM	84A-0185 / Air Purifying Full Face Organic Vapor with P100	/	115	<0.00009 MG/M3

TWA: 0.00002

Based on a total time of 115 minutes.

ID: 11529 UIC: COMMAND: SHOP: 26-D6 SAMPLE DATE: 10/4/2002

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003
Time-Weighted Average Exposures

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-012-04 High Velocity Oxyfuel (HVOF) Spraying	HVOF SPRAYING SHAFT	B-163 /BLDG. 163/PLASMA ARC ROOM	/ None Worn	METCO 5803 /	210	<0.00005 MG/M3

TWA: 0.00002

Based on a total time of 210 minutes.

ID: 54473 UIC: COMMAND: SHOP: CED SAMPLE DATE: 11/19/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	B 815 /BLAST BOOTH 2	/ Supplied Air Hood	GARNET /	105	0.0044 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	B 815 /BLAST BOOTH 2	/ Supplied Air Hood	GARNET /	15	0.0147 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	B 815 /BLAST BOOTH 2	/ Supplied Air Hood	GARNET /	15	0.0077 MG/M3

TWA: 0.0017

Based on a total time of 135 minutes.

ID: 56964 UIC: COMMAND: SHOP: R90 - P SHOP SAMPLE DATE: 10/9/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	B400 /BOOTH 3	/ Supplied Air Helmet Continuous Flow without Escape	30-40 GARNET GRIT /	15	0.48 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	B400 /BOOTH 3	/ Supplied Air Helmet Continuous Flow without Escape	30-40 GARNET GRIT /	15	0.4533 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	B400 /BOOTH 3	/ Supplied Air Helmet Continuous Flow without Escape	30-40 GARNET GRIT /	15	1.023 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	B400 /BOOTH 3	/ Supplied Air Helmet Continuous Flow without Escape	30-40 GARNET GRIT /	15	<0.0333 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	B400 /BOOTH 3	/ Supplied Air Helmet Continuous Flow without Escape	30-40 GARNET GRIT /	15	0.4767 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	B400 /BOOTH 3	/ Supplied Air Helmet Continuous	30-40 GARNET GRIT /	15	1.0567 MG/M3

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003
Time-Weighted Average Exposures

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
				Flow without Escape			
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	B400 /BOOTH 3	/ Supplied Air Helmet Continuous Flow without Escape	30-40 GARNET GRIT /	15	0.2017 MG/M3

TWA: 0.1161

Based on a total time of 105 minutes.

ID: 57094 UIC: COMMAND: SHOP: 71B SAMPLE DATE: 11/26/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-05 Abrasive Blast, Shot	BLASTING HATCHES	B409 /BLAST BOOTH	/ Supplied Air Hood Continuous Flow without Escape	/	15	0.00356 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-05 Abrasive Blast, Shot	BLASTING HATCHES	B409 /BLAST BOOTH	/ Supplied Air Hood Continuous Flow without Escape	/	15	0.0142 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-05 Abrasive Blast, Shot	BLASTING HATCHES	B409 /BLAST BOOTH	/ Supplied Air Hood Continuous Flow without Escape	/	15	0.00967 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-05 Abrasive Blast, Shot	BLASTING HATCHES	B409 /BLAST BOOTH	/ Supplied Air Hood Continuous Flow without Escape	/	15	0.06233 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-05 Abrasive Blast, Shot	BLASTING HATCHES	B409 /BLAST BOOTH	/ Supplied Air Hood Continuous Flow without Escape	/	15	0.18367 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-05 Abrasive Blast, Shot	BLASTING HATCHES	B409 /BLAST BOOTH	/ Supplied Air Hood Continuous Flow without Escape	/	15	0.00713 MG/M3

TWA: 0.00877

Based on a total time of 90 minutes.

ID: 57173 UIC: COMMAND: SHOP: WC 120 SAMPLE DATE: 11/7/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING AIRCRAFT	B439 /HANGAR	/ Air Purifying Half Face Organic Vapor with	/	16	0.04812 MG/M3

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003
Time-Weighted Average Exposures

				Prefilter			
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING AIRCRAFT	B439 /HANGAR	/ Air Purifying Half Face Organic Vapor with Prefilter	/	15	0.05033 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING AIRCRAFT	B439 /HANGAR	/ Air Purifying Half Face Organic Vapor with Prefilter	/	16	0.04718 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING AIRCRAFT	B439 /HANGAR	/ Air Purifying Half Face Organic Vapor with Prefilter	/	16	0.03031 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING AIRCRAFT	B439 /HANGAR	/ Air Purifying Half Face Organic Vapor with Prefilter	/	18	0.07333 MG/M3

TWA: 0.00851
Based on a total time of 81 minutes.

ID: 60871 UIC: COMMAND: SHOP: FIRE DEPT ANNEX SAMPLE DATE: 10/31/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	SER-006-01 Protective Services, Fire, Training	FIRE EXTING CKS	B1430 /FIRESTATION ANNEX	/ None Worn	/	216	<0.00013 MG/M3

TWA: 0.00004
Based on a total time of 216 minutes.

ID: 60875 UIC: COMMAND: SHOP: FIRESTATION ANNEX SAMPLE DATE: 10/31/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	SER-006-01 Protective Services, Fire, Training	FIRE EXTINGUIESHER CKS	B1430 /FIRESTATION ANNEX	/ None Worn	/	207	<0.00014 MG/M3

TWA: 0.00004
Based on a total time of 207 minutes.

ID: 61291 UIC: COMMAND: SHOP: 71A/B SAMPLE DATE: 3/11/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	BLASTBOOTH /BLASTBOOTH	/ Supplied Air Hood Continuous Flow with Escape	20 GRIT MEDIA /	175	0.01899 MG/M3

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003
Time-Weighted Average Exposures

TWA: 0.00692

Based on a total time of 175 minutes.

ID: 61307 UIC: COMMAND: SHOP: 71A/B SAMPLE DATE: 3/12/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	BLASTBOOTH /BLASTBOOTH	/ Supplied Air Hood Continuous Flow with Escape	20 GRIT MEDIA /	135	<0.00047 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	BLASTBOOTH /BLASTBOOTH	/ Supplied Air Hood Continuous Flow with Escape	20 GRIT MEDIA /	201	0.00114 MG/M3

TWA: 0.00057

Based on a total time of 336 minutes.

ID: 61380 UIC: COMMAND: SHOP: 500 DIVISON SAMPLE DATE: 3/4/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING HELO BOARDS	B1553 /CORROSION CONTROL	/ Air Purifying Half Face Organic Vapor with Prefilter	PNEUMATIC SANDERS /	174	0.00633 MG/M3

TWA: 0.00229

Based on a total time of 174 minutes.

ID: 61421 UIC: COMMAND: SHOP: 67H SAMPLE DATE: 4/16/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	BLASTBOOTH /67H BLASTBOOTH	/ Supplied Air Helmet Continuous Flow with Escape	GRADE 4 RODS /	254	<0.00029 MG/M3

TWA: 0.00011

Based on a total time of 254 minutes.

ID: 61487 UIC: COMMAND: SHOP: 500 SAMPLE DATE: 4/24/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	PNEUMATIC SANDING	CORROSIONC /CORROSSION CONTROL	/ Air Purifying Half Face Organic Vapor with HEPA	PNEUMATIC SANDERS /	120	0.00377 MG/M3

TWA: 0.00094

Based on a total time of 120 minutes.

ID: 61551 UIC: COMMAND: SHOP: 71A/B SAMPLE DATE: 4/8/2003

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003

Time-Weighted Average Exposures

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	BLASTBOOTH /BLASTBOOTH	/ Supplied Air Hood Continuous Flow with Escape	20 GRIT MEDIA /	119	0.00333 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	BLASTBOOTH /BLASTBOOTH	/ Supplied Air Hood Continuous Flow with Escape	20 GRIT MEDIA /	176	0.0006 MG/M3

TWA: 0.00105

Based on a total time of 295 minutes.

ID: 61555 UIC: COMMAND: SHOP: 67H SAMPLE DATE: 4/9/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-03 Abrasive Blast, Mineral Grit	ABRASIVE BLASTING	BLASTBOOTH /BLASTBOOTH	/ Supplied Air Hood Continuous Flow with Escape	MAGIC MEDIA /	258	<0.00029 MG/M3

TWA: 0.00011

Based on a total time of 258 minutes.

ID: 62565 UIC: COMMAND: SHOP: CR2720 SAMPLE DATE: 10/18/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-013-02 Oxygen Cutting	TORCH CUTTING	B2720 /BOXCAR MAINT. FACILITY	21C-488 / Air Purifying Half Face HEPA	PAINT / CADMIUM	15	<0.00067 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-013-02 Oxygen Cutting	TORCH CUTTING	B2720 /BOXCAR MAINT. FACILITY	21C-488 / Air Purifying Half Face HEPA	PAINT / CADMIUM	15	<0.00067 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-013-02 Oxygen Cutting	TORCH CUTTING	B2720 /BOXCAR MAINT. FACILITY	21C-488 / Air Purifying Half Face HEPA	PAINT / CADMIUM	28	<0.00036 MG/M3

TWA: 0.00004

Based on a total time of 58 minutes.

ID: 62813 UIC: COMMAND: SHOP: CR3234 SAMPLE DATE: 11/15/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	MECH PAINT REMOVAL	B3234 /SANDING ROOM	84A-0147 / Air Purifying Full Face	PAINT DUST / FIBERGLASS	21	<0.001 MG/M3

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003

Time-Weighted Average Exposures

				HEPA			
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	MECH PAINT REMOVAL	B3234 /SANDING ROOM	84A-0147 / Air Purifying Full Face HEPA	PAINT DUST / FIBERGLASS	15	0.054 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	MECH PAINT REMOVAL	B3234 /SANDING ROOM	84A-0147 / Air Purifying Full Face HEPA	PAINT DUST / FIBERGLASS	15	<0.002 MG/M3

TWA: 0.00176

Based on a total time of 51 minutes.

ID: 65973 UIC: COMMAND: SHOP: 95443 SAMPLE DATE: 1/15/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	DRILLING ANCHOR NUTS	BLDG. 137 /HANGAR	/ None Worn	/	16	0.01498 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING FLOORBOARD	BLDG. 137 /HANGAR	/ None Worn	/	19	0.04537 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING FLOORBOARD	BLDG. 137 /HANGAR	/ None Worn	/	101	0.00494 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	ALODINE APPLICATION	BLDG. 137 /HANGAR	/ None Worn	/	17	0.01343 MG/M3

TWA: 0.00381

Based on a total time of 153 minutes.

ID: 65974 UIC: COMMAND: SHOP: 95443 SAMPLE DATE: 1/15/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	GRINDING	BLDG. 137 /INSIDE H53J FUSELAGE	/ None Worn	/	15	0.01295 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	GRINDING	BLDG. 137 /H-53 HANGAR	/ None Worn	/	15	0.00595 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	GRINDING	BLDG. 137 /H-53 HANGAR	/ None Worn	/	125	0.00617 MG/M3

TWA: 0.0022

Based on a total time of 155 minutes.

ID: 65996 UIC: COMMAND: SHOP: 95662 SAMPLE DATE: 1/21/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /CH46E INTERIOR	/ Air Purifying Half Face P100	/	15	0.00245 MG/M3

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003
Time-Weighted Average Exposures

7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /CH46E INTERIOR	/ Air Purifying Half Face P100	/	15	0.00288 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /CH46E INTERIOR	/ Air Purifying Half Face P100	/	303	0.0008 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /CH46E INTERIOR	/ Air Purifying Half Face P100	/	15	0.00224 MG/M3

TWA: 0.00074
Based on a total time of 348 minutes.

ID: 65997 UIC: COMMAND: SHOP: 95662 SAMPLE DATE: 1/21/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT CORROSION	BLDG. 137 /CH46 HANGAR	/ Air Purifying Full Face P100	/	15	0.00365 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT CORROSION	BLDG. 137 /CH46 HANGAR	/ Air Purifying Full Face P100	/	15	0.00307 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT CORROSION	BLDG. 137 /CH46 HANGAR	/ Air Purifying Full Face P100	/	15	0.00291 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT CORROSION	BLDG. 137 /CH46 HANGAR	/ Air Purifying Full Face P100	/	338	0.0005 MG/M3

TWA: 0.00065
Based on a total time of 383 minutes.

ID: 65998 UIC: COMMAND: SHOP: 95662 SAMPLE DATE: 1/21/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /H-46 HANGAR AC 720	/ Unknown Code Entered: Air Purifying Half Face 3M-6200	/	15	0.00346 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /H-46 HANGAR AC 720	/ Unknown Code Entered: Air Purifying Half Face 3M-6200	/	15	<0.00177 MG/M3
7440-47-3E Chromium (VI), Insoluble	IND-010-00 Metal Machining, Multiple	CLEAN/TREAT	BLDG. 137 /H-46 HANGAR AC 720	/ Unknown Code	/	335	0.00124 MG/M3

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003
Time-Weighted Average Exposures

Compounds NOC (As Cr)	Operations			Entered: Air Purifying Half Face 3M-6200			
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /H-46 HANGAR AC 720	/ Unknown Code Entered: Air Purifying Half Face 3M-6200	/	15	<0.00177 MG/M3
TWA: 0.00105							
Based on a total time of 380 minutes.							
ID: 65999 UIC:	COMMAND:		SHOP: 95662		SAMPLE DATE: 1/21/2003		
CAS No. & STRESSOR	**OPCODE & DESCRIPTION**	**TASK**	**LOCATION / WORKSITE**	**TC # / RESP TYPE**	**MATERIALS**	**TIME**	**RESULTS**
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /CH46E BILGE	/ Air Purifying Half Face P100	/	389	0.00098 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /CH46E BILGE	/ Air Purifying Half Face P100	/	15	0.00582 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /CH46E BILGE	/ Air Purifying Half Face P100	/	15	0.0063 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /CH46E BILGE	/ Air Purifying Half Face P100	/	15	0.00416 MG/M3
TWA: 0.0013							
Based on a total time of 434 minutes.							
ID: 66004 UIC:	COMMAND:		SHOP: 95662		SAMPLE DATE: 1/22/2003		
CAS No. & STRESSOR	**OPCODE & DESCRIPTION**	**TASK**	**LOCATION / WORKSITE**	**TC # / RESP TYPE**	**MATERIALS**	**TIME**	**RESULTS**
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING INTERIOR	BLDG. 137 /CH46 INTERIOR	/ Air Purifying Half Face P100	/	15	<0.00161 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	PARTS REPLACE, ALODINE	BLDG. 137 /CH46 INTERIOR	/ Air Purifying Half Face P100	/	295	0.00032 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	CLEAN AND TREAT	BLDG. 137 /CH46 INTERIOR	/ Air Purifying Half Face P100	/	15	<0.00161 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING INTERIOR	BLDG. 137 /CH46 INTERIOR	/ Air Purifying Half Face P100	/	15	<0.00161 MG/M3

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003
Time-Weighted Average Exposures

TWA: 0.0003

Based on a total time of 340 minutes.

ID: 66005 UIC: COMMAND: SHOP: 95662 SAMPLE DATE: 1/22/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	GRINDING OF CORROSION	BLDG. 137 /CH46 HANGAR	/ Unknown Code Entered: Air Purifying Full Face 2040	/	302	0.00056 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	GRINDING OF CORROSION	BLDG. 137 /CH46 HANGAR	/ Unknown Code Entered: Air Purifying Full Face 2040	/	15	<0.00161 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	GRINDING OF CORROSION	BLDG. 137 /CH46 HANGAR	/ Unknown Code Entered: Air Purifying Full Face 2040	/	15	0.00479 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	GRINDING OF CORROSION	BLDG. 137 /CH46 HANGAR	/ Unknown Code Entered: Air Purifying Full Face 2040	/	15	<0.00161 MG/M3

TWA: 0.00057

Based on a total time of 347 minutes.

ID: 66006 UIC: COMMAND: SHOP: 95662 SAMPLE DATE: 1/22/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CLEAN/TREAT	BLDG. 137 /CH46 HANGAR	/ Air Purifying Half Face P100	/	15	0.00483 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CLEAN/TREAT	BLDG. 137 /CH46 HANGAR	/ Air Purifying Half Face P100	/	15	0.0077 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CLEAN/TREAT	BLDG. 137 /CH46 HANGAR	/ Air Purifying Half Face P100	/	15	0.00701 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CLEAN/TREAT	BLDG. 137 /CH46 HANGAR	/ Air Purifying Half Face P100	/	81	0.00072 MG/M3

TWA: 0.00073

Based on a total time of 126 minutes.

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003

Time-Weighted Average Exposures

ID: 66007 UIC: COMMAND: SHOP: 95662 SAMPLE DATE: 1/22/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /CH46 HANGAR	/ Air Purifying Half Face P100	/	15	0.00304 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /CH46 HANGAR	/ Air Purifying Half Face P100	/	15	0.00304 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /CH46 HANGAR	/ Air Purifying Half Face P100	/	15	<0.00171 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-010-00 Metal Machining, Multiple Operations	CLEAN/TREAT	BLDG. 137 /CH46 HANGAR	/ Air Purifying Half Face P100	/	60	0.001 MG/M3

TWA: 0.00035

Based on a total time of 105 minutes.

ID: 66031 UIC: COMMAND: SHOP: 95662 SAMPLE DATE: 1/24/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CLEAN/TREAT	BLDG. 137 /CH46E #721	/ Air Purifying Half Face P100	/	15	0.00459 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CLEAN/TREAT	BLDG. 137 /CH46E #721	/ Air Purifying Half Face P100	/	15	0.00607 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CLEAN/TREAT	BLDG. 137 /CH46E #721	/ Air Purifying Half Face P100	/	15	0.00498 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CLEAN/TREAT	BLDG. 137 /CH46E #721	/ Air Purifying Half Face P100	/	336	0.00052 MG/M3

TWA: 0.00085

Based on a total time of 381 minutes.

ID: 66348 UIC: COMMAND: SHOP: 93117-A SAMPLE DATE: 11/7/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING CH-46 #960	BLDG. 245 /OLD PAINT HANGAR	/ Air Purifying Half Face HEPA	/	15	<0.00162 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING CH-46 #960	BLDG. 245 /OLD PAINT HANGAR	/ Air Purifying Half Face	/	15	<0.00162 MG/M3

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003
Time-Weighted Average Exposures

				HEPA			
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING CH-46 #960	BLDG. 245 /OLD PAINT HANGAR	/ Air Purifying Half Face HEPA	/	116	0.00301 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING CH-46 # 960	BLDG. 245 /OLD PAINT HANGAR	/ Air Purifying Half Face HEPA	/	17	<0.00143 MG/M3

TWA: 0.00083

Based on a total time of 163 minutes.

ID: 66352 UIC: COMMAND: SHOP: 93117-A SAMPLE DATE: 11/7/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING CH-46 #960	BLDG. 245 /OLD PAINT HANGAR	/ Air Purifying Half Face HEPA	/	15	0.01209 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING CH-46 #960	BLDG. 245 /OLD PAINT HANGAR	/ Air Purifying Half Face HEPA	/	67	0.00462 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING CH-46 #960	BLDG. 245 /OLD PAINT HANGAR	/ Air Purifying Half Face HEPA	/	13	0.00734 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING CH-46 #960	BLDG. 245 /OLD PAINT HANGAR	/ Air Purifying Half Face HEPA	/	55	0.00844 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-11 Metal Cleaning Mechanical, Sanding	SANDING CH-46 #960	BLDG. 245 /OLD PAINT HANGAR	/ Air Purifying Half Face HEPA	/	18	0.00608 MG/M3

TWA: 0.00242

Based on a total time of 168 minutes.

ID: 66393 UIC: COMMAND: SHOP: 95443 SAMPLE DATE: 12/18/2002

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CORROSION REMOVAL	BLDG. 137 /CH-53 BILGE	84A-2561 / Air Purifying Half Face P100	/	215	0.01173 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CORROSION REMOVAL	BLDG. 137 /CH-53 BILGE	84A-2561 / Air Purifying Half Face P100	/	187	0.0216 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CORROSION REMOVAL	BLDG. 137 /CH-53 BILGE	84A-2561 / Air Purifying	/	15	0.22399 MG/M3

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003
Time-Weighted Average Exposures

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
				Half Face P100			
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CORROSION REMOVAL	BLDG. 137 /CH-53 BILGE	84A-2561 / Air Purifying Half Face P100	/	15	0.05988 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CORROSION REMOVAL	BLDG. 137 /CH-53 BILGE	84A-2561 / Air Purifying Half Face P100	/	15	0.14789 MG/M3
TWA: 0.02716							
Based on a total time of 447 minutes.							
ID: 66394 UIC:	COMMAND:		SHOP: 95443		SAMPLE DATE: 12/18/2002		
CAS No. & STRESSOR	**OPCODE & DESCRIPTION**	**TASK**	**LOCATION / WORKSITE**	**TC # / RESP TYPE**	**MATERIALS**	**TIME**	**RESULTS**
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CORROSION REMOVAL	BLDG. 137 /CH-53 BILGE	84A-2561 / Air Purifying Half Face P100	/	15	0.0026 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CORROSION REMOVAL	BLDG. 137 /CH-53 BILGE	84A-2561 / Air Purifying Half Face P100	/	52	0.00211 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-001-08 Metal Cleaning Mechanical, Grinding	CORROSION REMOVAL	BLDG. 137 /CH-53 BILGE	24A-2561 / Air Purifying Half Face P100	/	215	0.00682 MG/M3
TWA: 0.00336							
Based on a total time of 282 minutes.							
ID: 68901 UIC:	COMMAND:		SHOP: 36133		SAMPLE DATE: 10/1/2002		
CAS No. & STRESSOR	**OPCODE & DESCRIPTION**	**TASK**	**LOCATION / WORKSITE**	**TC # / RESP TYPE**	**MATERIALS**	**TIME**	**RESULTS**
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-013-07 Plasma Cutting	MANUAL PLASMA CUTTING	B9-OUTSIDE /NO LEV; WORK DONE OUTSIDE	/ Air Purifying Half Face HEPA	AL6XN STAINLESS STEEL /	110	<0.00009 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-013-07 Plasma Cutting	MANUAL PLASMA CUTTING	B9-OUTSIDE /NO LEV; WORK DONE OUTSIDE	/ Air Purifying Half Face HEPA	AL6XN STAINLESS STEEL /	70	0.02028 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-013-07 Plasma Cutting	MANUAL PLASMA CUTTING	B9-OUTSIDE /NO LEV; WORK DONE OUTSIDE	/ Air Purifying Half Face HEPA	AL6XN STAINLESS STEEL /	40	0.03499 MG/M3
TWA: 0.00589							
Based on a total time of 220 minutes.							
ID: 71095 UIC:	COMMAND		SHOP: 36133		SAMPLE DATE: 2/1/2003		

Attachment 3: Personal Breathing Zone Air Exposure Samples for Hexavalent Chromium 10/1/2002 to 4/24/2003
Time-Weighted Average Exposures

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-013-02 Oxygen Cutting	TORCH CUT COATED STEEL	1-LOADDOCK /PROPELLER FAN & TEPCO LEV	/ Air Purifying Full Face Multi-Gas	STEEL WALL COATED W/ / .038%PB,2%CR,<.01% CD	131	0.00241 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-013-02 Oxygen Cutting	TORCH CUT COATED STEEL	1-LOADDOCK /PROPELLER FAN & TEPCO LEV	/ Air Purifying Full Face Multi-Gas	STEEL WALL COATED W/ / .038%PB,2%CR,<.01% CD	250	0.00259 MG/M3

TWA: 0.00201

Based on a total time of 632 minutes.

ID: 71096 UIC: COMMAND: SHOP: 36133 SAMPLE DATE: 2/1/2003

CAS No. & STRESSOR	OPCODE & DESCRIPTION	TASK	LOCATION / WORKSITE	TC # / RESP TYPE	MATERIALS	TIME	RESULTS
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-013-02 Oxygen Cutting	TORCH CUT COATED STEEL	1-LOADDOCK /PROPELLER FAN & TEPCO LEV	/ Air Purifying Full Face Multi-Gas	STEEL WALL COATED W/ / .038%PB,2%CR,<.01% CD	250	0.00175 MG/M3
7440-47-3E Chromium (VI), Insoluble Compounds NOC (As Cr)	IND-013-02 Oxygen Cutting	TORCH CUT COATED STEEL	1-LOADDOCK /PROPELLER FAN & TEPCO LEV	/ Air Purifying Full Face Multi-Gas	STEEL WALL COATED W/ / .038%PB,2%CR,<.01% CD	137	0.00231 MG/M3

TWA: 0.00157

Based on a total time of 387 minutes.

Attachment 4: Response to Issues (Section II Questions) – Naval Air Community

Submitted by representatives from the Naval Air Force (NAVAIR).

The following comments were provided by members of safety and health offices serving Naval Aircraft Depots. Members are technical personnel responsible for executing OSHA requirements in depot level aircraft repair, renovation and rework.

The Occupational Safety and Health Administration (OSHA) issued a proposed rule to amend the existing standard for hexavalent chromium. OSHA is proposing separate regulatory texts for general industry, construction, and shipyards (maritime) in order to tailor requirements to these specific industry sectors. This is a response to OSHA's invitation for written comments regarding discussions presented in the preamble with specific comments on the proposed rule published in the Federal Register, Vol. 69, No. 191, Monday, October 4, 2004, pages 59306 through 59474.

Question 10 – ***OSHA presented a profile of the affected worker population with estimates by application group, job category and distribution of exposures. OSHA is asking for additional data to refine the profile of the worker population*****.**

Comment:
OSHA does not provide information specific to the aircraft repair industry in the Proposed Rule. Both private sector and government aircraft use paint primers containing hexavalent chromium compounds including barium chromate, strontium chromate, and zinc chromate. No equally effective substitutes are currently available. Corrosion control activities are essential to aircraft maintenance and require metal cleaning processes that create exposure in excess of the proposed Permissible Exposure Limit (PEL). Of special concern to NAVAIR is the fact that parts making up the frame of the aircraft are cleaned of corrosion (by necessity paint and primer is removed also), re-treated with chromate containing conversion coating, re-primed with chromate containing primer and repainted. Sometimes this work occurs on the aircraft, and sometimes the parts are removed. This work is performed by Sheet Metal workers in aircraft hangars built for assembly and disassembly and are not ventilated.

Corrosion control work is done in almost every shop in our industrial population. Of particular concern are the sections of the aircraft where corrosion is worked in place on the aircraft. Although we have abrasive blasting facilities used for corrosion control that can hold aircraft, much of the corrosion is not accessible at any one point in the aircraft repair process. To keep the aircraft in a ventilated facility suitable for isolating chromium VI exposures would require keeping the aircraft in the facility for the entire period of aircraft re-work or moving an aircraft from hangars where they are disassembled back to the Corrosion Control facility several times. Neither of these options are feasible in our facilities (we average two or three dozen aircraft at a time) and corrosion control must be done in standard aircraft hangars. The proposed limit will require all of our hangars to be regulated areas. Ventilated tools often cannot reach into the tight spaces and angles found in the airframe. We have used glove bags to try to reduce exposure. They were somewhat effective, but limited. Corrosion control work in glove bags still exceeded the proposed PEL by several times. In addition, they create serious ergonomic concerns including posture and lighting problems.

In summary, the aircraft repair industry will have challenges equal or greater to those in ship-building.

Question 11: ***OSHA is requesting job categories, description of operations, number of individuals potentially exposed to hexavalent chromium, and additional exposure data.***

Comment:
Air sampling data from a NAVAIR depot level facility are provided in Table 1. Many of these processes hold no surprise. However, there are a couple of points we would like to point out:

First, there are many area samples (these are AREA SAMPLE or NA under the column OCCTITLE) over the proposed limit. These samples were typically 10 feet away from the process generating the exposure.

Second, while de-painting (abrasive blasting) and painting are widely recognized as processes that cause exposure, I am not sure there is widespread recognition of the exposure potential for the Sheet Metal trades. The Air Force publishes technical reports online. Of the available reports, "corrosion control" was looked at as the abrasive blasting (de-painting and corrosion control) where the aircraft is pulled into a ventilated hangar. Sheet Metal work, on the other hand, involves a great deal of corrosion removal, but it is primarily done in an open hangar environment. Notice the number of "area samples" that are associated with sheet metal work—the processes are grouped together.

Third, notice the process "Apply Pasagel" exceeds the proposed standard. This is a gel – like material applied to a part, essentially a liquid process. We are still investigating whether there was other abrasive work associated with the liquid application.

Question 13: ***OSHA is asking if there has been a trend within our industry to eliminate Cr(VI) from production processes, products and services. If so, OSHA is requesting comments on the success of substitution efforts. Commenters should estimate the percentage reduction in Cr(VI) is still necessary in their processes within product lines or production activities. OSHA also requests that commenters describe technical, economic or other deterrents to substitution.***

Comment:
Hexavalent chromium compounds are widely used as corrosion inhibitors in materials such as aircraft paint primers, sealants, and pre-paint surface treatments. These materials have a long history of providing superior corrosion protection in adverse conditions, particularly in harsh operational conditions frequently encountered with Navy and Marine

Corps aircraft. There are several ongoing efforts by material manufacturers, DoD activities, and aircraft manufacturers to identify and develop alternative products that do not contain hexavalent chromium. Although these investigative efforts span well over the past twelve years, no alternative products have yet been identified that perform as well. Corrosion resistance is the major roadblock. Testing has shown that several new products are marginally effective under limited conditions, however, there are significant risks associated with incorporating these as direct alternatives. Risks include corrosion damage to flight critical components, increased airframe corrosion, increased maintenance repair, increased part replacement frequency, and reduced lifespan of aging aircraft. Deterrents also include lack of available funding to develop, test, and implement alternative products. Testing must encompass both laboratory and field evaluations. Upon implementation, there will be significant expense to update technical manuals and drawings, and to incorporate contract changes.

Hexavalent chromium compounds are also widely used in chromium plating processes for aircraft components. Although there are several potential alternatives to chromium plating, it will take several years to qualify these coatings for fatigue critical and mission critical components. These components will require full-scale testing to qualify application of new coatings. In addition, money has not been programmed to implement these potential alternatives. It will take significant planning and funding to implement.

Question 14: ***OSHA is inquiring if any job category or employee in a workplace has exposures to Cr(VI) that raw air monitoring data do not adequately portray due to the short duration, intermittent or non-routine nature, or other unique characteristics of the exposure.***

Comment:
While we may have processes that are successfully controlled to the proposed PEL with ventilation, we do not have enough sampling to demonstrate this with confidence.

Question 15: ***OSHA requests the following information regarding engineering and work practice controls in your workplace or industry: a. Describe the operations in which the proposed PEL is being achieved most of the time by means of engineering and work practice controls. b. What engineering and work practice controls have been implemented in these operations? c. For all operations in facilities where Cr(VI) is used, what engineering and work practice controls have been implemented? If you have installed engineering controls or adopted work practices to reduce exposure to Cr(VI), describe the exposure reduction achieved and the cost of these controls. Where current work practices include the use of regulated areas and hygiene facilities, provide data on the implementation of these controls, including data on the costs of installation, operation, and maintenance associated with these controls. d. Describe additional engineering and work practice controls which could be implemented in each operation where exposure levels are currently above the proposed PEL to further reduce exposure levels. e. When these additional controls are implemented, to what levels can exposure be expected to be reduced, or what percent reduction is expected to be achieved? f. What are the costs and amount of time needed to develop, install and***

implement these additional controls? Will the added controls affect productivity? g. Are there any processes or operations for which it is not reasonably possible to implement engineering and work practice controls within two years to achieve the proposed PEL? If so, would allowing additional time for employers to implement engineering and work practice controls make compliance possible? How much additional time would be necessary?

Comment:
a. We believe our chrome electroplating operation is controlled most of the time through standard tank ventilation. However, some sample results are above the proposed PEL and we are not sure of the conditions that created excursions above the proposed PEL.

b. Ventilation per ACGIH Industrial Ventilation and PPE.

c. Engineering and work practice controls –

1. Walk-in abrasive blasting on aircraft and large components (De-painting and corrosion control): Cross-draft ventilation provided at a 100 fpm minimum. Downdraft ventilation provided at a minimum of 90 fpm. HEPA vacuums, hygiene facilities, and break rooms have been provided. Chromium VI exposures measured up to 1600 times the proposed PEL.

2. Paint priming in walk-in ventilated paint booths: All meet or exceed ACGIH and OSHA requirements. Painters have received training in techniques to minimize over spray and use high volume low-pressure (HVLP) paint guns. Recent sampling from a cross-draft booth ventilated at 160 fpm was 19 times the proposed PEL during paint priming of large component. Aircraft paint priming measured 4 ug/m3 in cross-draft ventilation provided at 110 fpm. Painting the interior of aircraft, even with auxiliary ventilation of 2 air horns at 1400 fpm (300 cubic feet per minute) and an axial fan at 1400 fpm (14,000 cfm) still produces chromium VI exposures at 54 ug/m3.

3. Sheet metal corrosion control on the aircraft: We have used glove bags (See Pictures 1 through 5) designed for asbestos abatement to control chromium VI exposures during aircraft corrosion removal operations in the bilge area of an H-53 helicopter and on the tail pylon of an H-53. Air samples collected from the artisan did not meet the proposed standard, although area samples did. An air sample from when the artisan cleaned the area where the glove bag was to be taped with alcohol and then taped the glove bag to the side of the tail pylon resulted in 1 ug/ m3.

4. We have also tried portable exhaust hoods (designated PAPCE in Table 1) during sheet metal corrosion control on the aircraft. These are shown in Pictures 6 and 7. Exposures were up to 27 ug/m3.

d. For abrasive blasting, we are trying local, duct-type exhaust in addition to cross-draft ventilation for the aircraft hangar. While there are some locally ventilated abrasive blasting “heads” they are too big and work primarily on flat surfaces and are unsuitable for aircraft.

For sheet metal corrosion control on the aircraft, we are investigating vacuum-assisted tools, glove bags, and wet sanding.

For aircraft and component paint priming we have investigated electrostatic sprayers, local exhaust in addition to paint booth exhaust without success.

e. There is significant doubt that 1 ug/m3 is achievable at a 95% confidence level without completely enclosing the operations and keeping the operator outside of the enclosure.

f. We have to do so much development and experimentation specific to each of our many affected processes to determine which engineering controls will be effective that an accurate cost estimate is impossible. I do not believe for most application there will be any one commercial off-the-shelf product that will control exposures. In all likelihood, it will require a combination of control methods. Our estimates right now are that added controls will greatly reduce productivity. For instance, setting up a glove bag for corrosion control took 25 minutes, but the size of the bag restricted the amount of work the could be done to 15 minutes. For corrosion control work, we are looking at twice the amount of set up time than actual productive time.

Questions 15, 17 and 18: ***OSHA requests information regarding costs for engineering and work practice controls, personal protective equipment (PPE) and hazard communication in your workplace or industry***.

Comment:
Cost estimates for two depot level aircraft repair facilities are provided in Tables 2 and 3.

Table 1
Air Sampling Results Greater Than the Proposed Permissible Exposure Limit (0.001 mg/m3)

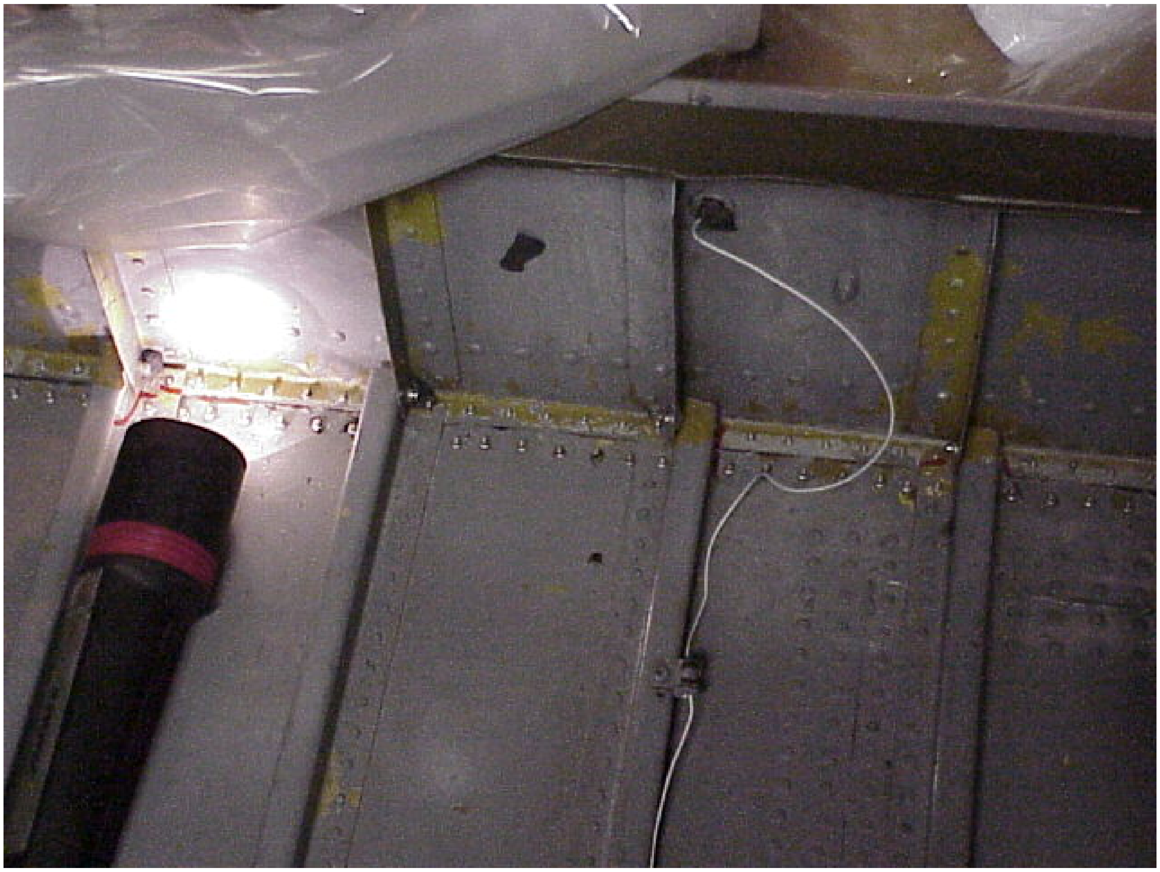
Process	OCCTITLE	SAMPLEDATE	TWA	TOT_TIME
Depaint Floor Boards	BLASTER	10-Feb-00	0.02938	95
Depaint H53 Aircraft	CONTRACTOR	27-Apr-04	0.0628	100
Depaint H53 Aircraft	EQUIP CLEANER/SNDBLSTR	27-Apr-04	0.05467	100
Depaint H53 Aircraft	SANDBLASTER	28-Aug-01	1.05508	401
Depaint H53 Aircraft	SANDBLASTER	28-Aug-01	1.54713	403
Depaint Floor Boards	SANDBLASTER	10-Jul-01	0.2166	163
Depaint Floor Boards	SANDBLASTER	10-Jul-01	0.02625	140
Depaint Floor Boards	CONTRACT EMPLOYEE	10-Jul-01	0.06154	211
Depaint Aircraft	SANDBLASTER	29-Nov-00	2.05729	228
Depaint Aircraft	BLASTER	29-Nov-00	3.12292	216
Depaint Aircraft	BLASTER	14-Jul-00	0.04771	170
Depaint Aircraft	SANDBLASTER	6-Apr-00	0.02803	185
Depaint Aircraft Components	CONTRACTOR	21-Apr-04	0.02688	208
Depaint Aircraft Components	SANDBLASTER	29-Aug-01	0.01124	178
Depaint Aircraft Components	BLASTER	16-Nov-00	0.07448	80
Depaint Aircraft Components	SANDBLASTER	27-Apr-00	0.00376	258
Blast Engine Containers	SANDBLASTER	6-Apr-04	0.00763	93
Blast Engine Containers	SANDBLASTER	6-Apr-04	0.00792	70
Aircraft Paint Prime (interior)	PAINTER	4-Mar-98	0.00217	285
Aircraft Paint Prime (interior)	PAINTER	12-Mar-01	0.22402	103
Aircraft Paint Prime (interior)	PAINTER	12-Mar-01	0.09644	104
Scuff Sand (A/C) (New Side)	PAINTER	26-Feb-01	0.00251	485
Paint Priming	PAINTER	04-Mar-04	0.00329	119
Paint Priming	PAINTER (CONTRACTOR)	10-Feb-04	0.0424	90
Paint Priming	PAINTER WORKER	12-Mar-03	0.02042	84
Sermetel Application	PAINTER WORKER	29-Aug-01	0.01647	70
Aircraft Paint Prime	PAINTER	05-Jun-98	0.00769	75
Chrome Plating	ELECTROPLATER	09-Dec-96	0.00128	435
Chrome Plating	NA	09-Dec-96	0.00134	485
Chrome Plating	ELECTROPLATER	07-Feb-01	0.00407	361
Sanding Blades	AIRCRAFT REPAIRER	14-May-97	0.00168	475
Sanding Blades	AIRCRAFT PARTS WORKER	19-Sep-00	0.00333	307
Apply Pasagel	PLASTICS WORKER	26-Feb-02	0.0033	75
Sanding Metal and Fiberglass	AREA SAMPLE	30-Oct-01	0.00184	420

Sanding Metal and Fiberglass	HELPER, PLASTIC FAB.	30-Oct-01	0.02597	425
Sanding Metal and Fiberglass	HELPER, PLASTIC FAB.	30-Oct-01	0.01367	425
Sanding Metal and Fiberglass	PLASTIC WORKER	30-Oct-01	0.00112	430
AH-1 and UH-1 Corrosion Control	AC SHEETMETAL WORKER	21-Aug-03	0.00174	376
AH-1 and UH-1 Corrosion Control	AREA SAMPLE	21-Aug-03	0.01013	404
AH-1 and UH-1 Corrosion Control	AREA SAMPLE	25-Jun-03	0.01565	400
AH-1 and UH-1 Corrosion Control	SHEETMETAL MECHANIC	25-Jun-03	0.04818	400
Sanding Corrosion Interior	SHEETMETAL WKR	16-Mar-04	0.05193	208
Sanding Corrosion Interior	AREA SAMPLE	16-Mar-04	0.00569	208
Sanding Corrosion Interior	SHEETMETAL WKR	16-Mar-04	0.04517	189
Sanding /Corrosion Control	AREA SAMPLE	30-Sep-03	0.00104	303
Sanding /Corrosion Control	SHEETMETAL CO-OP TRAIN	30-Sep-03	0.02381	222
Sanding /Corrosion Control	SHEETMETAL MECHANIC	11-Mar-03	0.00172	369
Sanding /Corrosion Control	SHEETMETAL MECHANIC	11-Mar-03	0.00172	369
Corrosion Control w/PAPCE	SHEET METAL WORKER	15-Jan-03	0.00381	153
Corrosion Control w/PAPCE	AREA SAMPLE	15-Jan-03	0.00325	170
Corrosion Control w/PAPCE	VIBRATION ANALY. MECH.	15-Jan-03	0.0022	155
Corrosion Control w/PAPCE	AREA SAMPLE	18-Dec-02	0.01254	440
Corrosion Control w/PAPCE	SHEET METAL WORKER	18-Dec-02	0.02716	447
Corrosion Control w/PAPCE	SHEET METAL MECHANIC	18-Dec-02	0.00336	282
Corrosion Control w/PAPCE	AREA SAMPLE	18-Dec-02	0.00625	437
Corrosion Control w/PAPCE	SHEET METAL MECHANIC	18-Dec-02	0.00305	215
Sanding /Corrosion Control	SHEETMETAL WORKER	16-Aug-02	0.0011	434
Sanding /Corrosion Control	SHEETMETAL MECHANIC	14-Aug-02	0.00176	395
Sanding /Corrosion Control	SHEETMETAL WORKER	11-Jul-02	0.00308	161
Sanding /Corrosion Control	SHEET METAL WORKER	19-Jun-02	0.00664	120
Sanding /Corrosion	SHEETMETAL HELPER	17-Jun-02	0.00324	373

Control				
Sanding /Corrosion Control	SHEET METAL MECH.	09-Apr-02	0.01537	304
Sanding /Corrosion Control	AREA SAMPLE	09-Sep-03	0.00173	360
Sanding /Corrosion Control	SHEETMETAL WORKER	09-Sep-03	0.00636	320
Sanding /Corrosion Control	SHEETMETAL MECHANIC	04-Mar-03	0.00515	246
Sanding /Corrosion Control	SHEETMETAL HELPER	04-Mar-03	0.00339	250
Corrosion Control w/PAPCE	SHEET METAL WORKER	21-Jan-03	0.0013	434
Corrosion Control w/PAPCE	SHEET METAL WORKER	21-Jan-03	0.00105	380
Sanding /Corrosion Control	SHEETMETAL MECHANIC	30-Aug-02	0.00108	360
Sanding /Corrosion Control	SHEETMETAL WORKER	28-Aug-02	0.00989	410
Sanding /Corrosion Control	AC SHEETMETAL HELPER	26-Aug-02	0.00892	462
Sanding /Corrosion Control	NA	26-Aug-02	0.00442	458
Sanding /Corrosion Control	SHEETMETAL WORKER	17-Jul-02	0.00207	334
Sanding /Corrosion Control	AIRCRAFT SHEETMETAL WK	12-Jul-02	0.00204	403
Sanding /Corrosion Control	AREA SAMPLE	12-Jul-02	0.00961	439
Sanding /Corrosion Control	AIRCRAFT SHEETMETAL WK	12-Jul-02	0.00431	358
Sanding /Corrosion Control	SHEET METAL WORKER	03-Jun-02	0.00339	445
Sanding /Corrosion Control	AREA SAMPLE	03-Jun-02	0.00248	440
Sanding /Corrosion Control	SHEET METAL WORKER	03-Jun-02	0.00645	445
Sanding /Corrosion Control	AREA SAMPLE	23-Apr-02	0.00231	385
Sanding /Corrosion Control	SHEET METAL HELPER	23-Apr-02	0.00622	390
Sanding /Corrosion Control	SHEETMETAL MECHANIC	14-Aug-02	0.00268	420
Sanding /Corrosion Control	SHEETMETAL MECHANIC	14-Aug-02	0.0014	232
Sanding /Corrosion Control	NA	29-Aug-02	0.00175	45
Sanding /Corrosion Control	AREA SAMPLE	27-Aug-02	0.00561	433
Sanding /Corrosion Control	AC SHEETMETAL MECH.	27-Aug-02	0.00267	426
Sanding /Corrosion Control	NA	27-Aug-02	0.00171	445

Sanding /Corrosion Control	SHEETMETAL MECHANIC	15-Aug-02	0.00831	430
Sanding /Corrosion Control	AC SHEETMETAL HELPER	30-Jul-02	0.00372	498
Sanding /Corrosion Control	SHEETMETAL MECHANIC	26-Jul-02	0.12132	45
Sanding /Corrosion Control	NA	28-Aug-02	0.00107	447
Sanding /Corrosion Control	CONTRACTOR	12-Feb-04	0.19122	530
Sanding /Corrosion Control	AREA SAMPLE	12-Feb-04	0.04152	365
Sanding /Corrosion Control	SHEETMETAL WORKER	06-Sep-02	0.00838	351
Sanding /Corrosion Control	CONTRACTOR	05-Sep-02	0.00108	435
Sanding /Corrosion Control	NA	05-Sep-02	0.00224	480
Sanding /Corrosion Control	CONTRACTOR	05-Sep-02	0.00167	434
Sanding /Corrosion Control	NA	15-Aug-02	0.00162	416
Sanding /Corrosion Control	AIRCRAFT MECHANIC	15-Aug-02	0.00334	420
Sanding /Corrosion Control	SHEETMETAL MECH	24-Mar-04	0.00812	127
Sanding /Corrosion Control	NA	24-Mar-04	0.0011	160
Sanding /Corrosion Control	SHEETMETAL HELPER	06-Mar-03	0.0016	164
Sanding /Corrosion Control	SHEETMETAL HELPER	23-Aug-02	0.00274	411
Sanding /Corrosion Control	NA	23-Aug-02	0.00276	475
Sanding /Corrosion Control	CONTRACTOR	23-Aug-02	0.00255	415
Sanding /Corrosion Control	NA	23-Aug-02	0.00168	480
Sanding /Corrosion Control	CONTRACTOR	22-Aug-02	0.03322	402
Sanding /Corrosion Control	SHEETMETAL MECHANIC	22-Aug-02	0.00615	380
	SHEET METAL MECH.	06-May-02	0.01101	400

Picture 1



Glove bag containment for aircraft corrosion removal

This is under the floorboards inside the fuselage of an H-53 helicopter. The yellow area illuminated by the flashlight is typical of the work performed by Sheet Metal Mechanics to remove corrosion. The fasteners are cadmium plated and the yellow is barium chromate, zinc chromate or strontium chromate. This area is not accessible until the floorboards are removed. Abrasive blasting is not possible unless the aircraft is disassembled further-notice the wiring.

Picture 2

Compare the size and angle of the area that needs to be cleaned to one of the smallest ventilated tools available. They are as big or bigger than the flashlight.

Picture 3

Sheet metal artisans prepare the glove bag. Because of the structure of the aircraft, wiring, access holes, etc., sealing the glove bag took several hours. The next attempt will utilize a frame to lift the glove bag off the surface requiring corrosion removal.

Picture 4

Picture 5

Picture 6
Portable Air Pollution Collection Equipment (PAPCE)

Picture 7

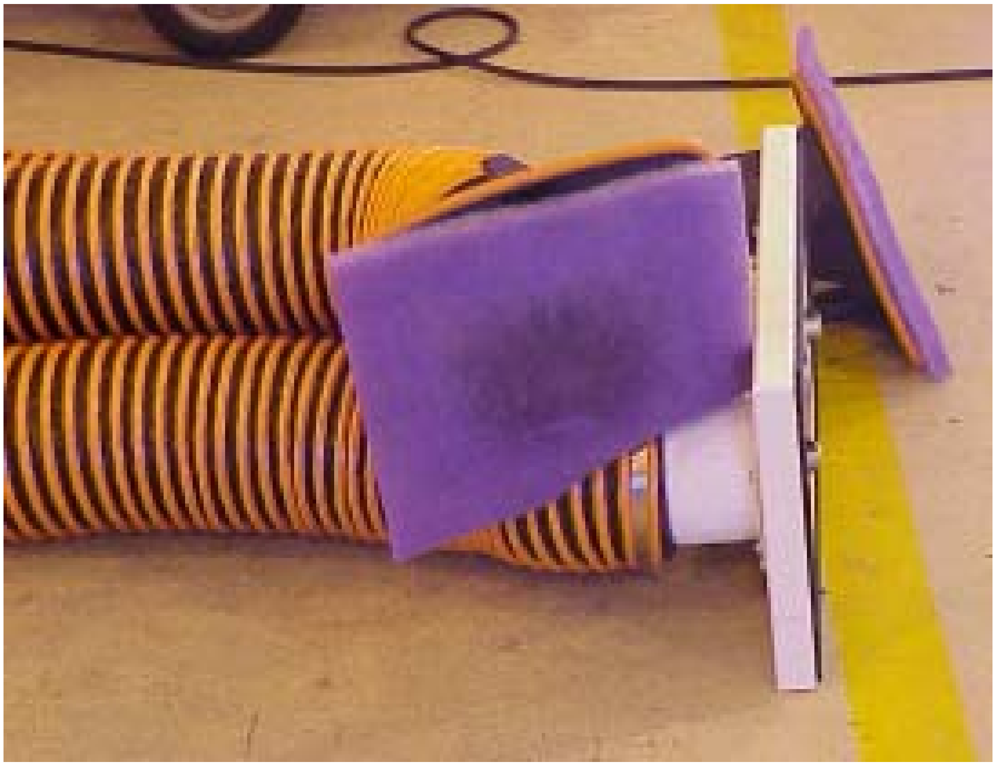


Table 2
Cost Estimates for Naval Air Depot #1 (Aircraft Repair/Overhaul)

Requirement	Unit Cost	Number Required	Total (Initial)	Total (Annual)	Time (hours)	Time (Man-Years)	BASIS
Industrial Hygiene Sampling	$50.00	1680	$84,000.00	$50,400.00	2688	1.68	Compliance Sampling Sheet and Processes to Sample Sheet
Warning Signs	$3.00	132	$396.00	$50.00			
Air Supplied Respirator	$335.00	189	$63,315.00	$32,000.00			
Full-Face Respirator	$185.00	76	$14,060.00	$7,000.00			
Breathing Air Panels	$2,500.00	90	$225,000.00	$25,000.00			
Breathing Air Sampling			$0.00				
Breathing Panel Calibration			$0.00				
Half Face Respirator	$18.00	250	$4,500.00	$4,500.00			
Replacement Cartridges	$6.18	8400	$51,912.00	$51,912.00			700 employees and once a month change out
Respirator Cleaning Materials	$1.86	140000	$260,400.00	$260,400.00			700 employees and once a day cleaning (200 work days)
Tyvek Coveralls	$4.50	70000	$315,000.00	$315,000.00			350 employees 200 days per year
Laundering	$5.50	18200	$100,100.00	$100,100.00			350 employees 52 weeks per year

Gloves	$2.50	36400	$91,000.00	$91,000.00			700 employees 52 weeks
Change Rooms and Shower			$600,000.00	$60,000.00			
Soap, towels	$0.50	900	$450.00	$450.00			
HEPA vacuum	$1,580.00	230	$363,400.00	$36,000.00			
HEPA vacuum filters	$212.00	230	$48,760.00	$48,760.00			
Ventilation Upgrades			$0.00				
Ventilation Booth	$37,000.00	30	$1,110,000.00				
Ventilated Tools	$5,000.00	122	$610,000.00				
Glove Bags			$0.00				
Waste disposal bags			$0.00				
Medical Exam			$0.00		2500	1.56	2.5 hours per employee, inc. travel time
Training			$0.00		4000	2.5	1 hour per employee
Time for employee showering			$0.00		17500	10.9	7.5 minutes per employee per day (700 emp, 200 days)
Decontamination Existing Facilities			$0.00				
Lunchrooms							
			$3,942,293.00	$1,082,572.00			
			0				

Red Font=Expenses that could be reduced through engineering and process changes

$2,222,293.00 Initial

$1,082,572.00 Annual

Table 3
Cost Estimates for Naval Air Depot #2 (Aircraft Repair/Overhaul)

Requirement	Unit Cost	Number Required	Total (Initial)	Total (Annual)
Full-Face (APR) Respirator	$210.00	314	$65,940.00	$6,594.00
Full-Face (PD) Respirator	$1,110.00	90	$99,900.00	$10,000.00
Respirator Cleaning Materials	$1.00	40000	$40,000.00	$40,000.00
Breathing Air Units	$10,200.00	6	$61,200.00	$10,200.00
Breathing Air Sampling	$100.00	80	$8,000.00	$8,000.00
Replacement Cartridges	$18.00	4800	$86,400.00	$86,400.00
Fit test machines	8400	2	$16,800.00	$1,680.00
Fit test machine calibration	$650.00	2	$1,300.00	$1,300.00
Ventilated Tools	$5,000.00	69	$345,000.00	$35,000.00
HEPA vacuum	$1,580.00	25	$39,500.00	$3,500.00
HEPA vacuum filters	$212.00	25	$5,300.00	$5,300.00
Tyvek Coveralls	$4.50	40000	$180,000.00	$180,000.00
Gloves	$2.50	40000	$100,000.00	$100,000.00

Large Sinks	$2,000.00	60	$120,000.00	
Respirator Cleaning Station	$1,000.00	30	$30,000.00	
Warning Signs	$50.00	100	$5,000.00	
Portable Ventilation Units	$5,000.00	61	$305,000.00	$3,000.00
Lockers	$300.00	360	$108,000.00	
Clean Tank Covers	$9,000.00	3	$27,000.00	
PPE/Equipment/Facilites	Cost		$1,644,340.00	$490,974.00
Labor cost	Cost		103,074	106,166
	Total Cost		1,747,414	597,140