BASIS FOR AND PRACTICAL METHODS OF CONTROLLING PAINTING ACTIVITIES AT THE SEQUOYAH NUCLEAR PLANT

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Abstract

Sequoyah Nuclear Plant (SQN) follows the guidance presented in Regulatory Guide (R.G.) 1.52, "Design, Testing, and Maintenance Criteria for Atmospheric Cleanup System Air Filtration and Adsorption System Units of Light-Water-Cooled Nuclear Power Plants" in protecting its charcoal filter trains from the effects of painting and other chemical releases. SQN, as well as other nuclear facilities around the country, have the problem of how to address the issue of protection of Engineered Safety Feature (ESF) filter systems from degradation due to communication with airborne hydrocarbons (i.e., primarily paints and solvents). R.G. 1.52 (and a similar statement from R.G. 1.140) states in part, "Testing should be performed ... following painting, fire, or chemical release in any ventilation zone communicating with the system...," and requires that a test be performed upon any kind of painting or chemical release. This is considered overly restrictive if the activity is minor and in a location remote from the charcoal filters.

Charcoal filters used in air cleaning systems are required to filter out radioactive iodine from an airstream before its release from the plant to the environment. Charcoal filters will age with time because of their ability to adsorb many different types of material. This aging affects the charcoal by lowering its iodine retention efficiency, and therefore the charcoal needs to be protected from the effects of chemicals such as paint fumes.

An integrated approach was used to determine a basis for and methods of controlling painting (and other chemical releases) for the protection of charcoal filters. The areas investigated were:

1. Test charcoal efficiency after exposure to known contaminants
2. Charcoal and its ability to adsorb contaminants
3. Other utility experience
4. Potential contaminants in paint and their release rates
5. Air change rates
6. Procedural and administrative controls

The TVA SQN testing results supported previous industry papers addressing hydrocarbon effects on charcoal. The results indicated charcoal (TVA uses TEDA and KI impregnated charcoal) can meet its required efficiencies after some exposure to hydrocarbons. Industry information indicates that charcoal may start having lowered efficiencies with as little as 5 percent, by weight, in contaminants absorbed by the charcoal. SQN has chosen 0.5 percent as its administrative limit for charcoal contaminants. The administrative controls, implemented as a result of this effort, have been well received by the plant (craft, operations, management, and engineers) and have not exposed the filters to any excessive amounts contaminants.

Background

SQN follows the guidance presented in R.G. 1.52, "Design, Testing, and Maintenance Criteria for Atmospheric Cleanup System Air Filtration and Adsorption System Units of Light-Water-Cooled Nuclear Power Plants" in respect to the design, operation and maintenance of the installed air cleaning systems. Charcoal filters are an integral part of air cleaning systems and are used to filter radioactive iodine from an airstream before its release from the plant to the environment. Charcoal filters will age with time because of their ability to adsorb many different types of material. Additionally, contaminants such as paint fumes, cleaning solvent fumes, and sealing material offgases will damage and contaminate charcoal which lowers its iodine adsorption efficiency. This aging affects the charcoal by lowering its iodine retention efficiency, and therefore the charcoal needs to be protected from the effects of chemicals such as paint fumes. SQN, as well as other nuclear facilities around the country, have the problem of how to address the issue of protection of Engineered Safety Feature (ESF) air cleaning and non-ESF air cleaning filter systems from degradation due to the effects of painting and other chemical releases (i.e., primarily paints and solvents). One method of addressing this problem is to strictly control painting activities in areas of the plant where such activities could jeopardize the efficiency of charcoal filters installed in air cleaning filter systems.

The NRC recognizes this ability of charcoal filters to adsorb materials and requires testing be performed when filters are exposed to chemicals. NRC R.G. 1.52 (and a similar statement from R.G. 1.140) states in part, "Testing should be performed ... following painting, fire, or chemical release in any ventilation zone communicating with the system...," and requires that a test be performed upon any kind of painting or chemical release. A strict interpretation of this statement requires that a test be performed upon any kind of painting or chemical release. This is considered overly restrictive if the activity that could release chemical fumes (i.e., painting) is minor and in a location remote from the charcoal filters. Therefore, an engineering basis is required addressing the effects of painting activities on charcoal.

SQN has five installed filter systems that contain charcoal filters and hence the need for a process to control paints and other chemicals that may harm the installed charcoal filters. The following are descriptions of the systems affected at SQN:

The Auxiliary Building Gas Treatment System (ABGTS) is used to filter radioactive particulates and iodine from the exhaust airstream and maintain the Auxiliary Building at a negative pressure with respect to outdoors. It is an ESF filter system in standby and only operated occasionally for testing. It performs its function following a LOCA, a fuel handling accident, and an Auxiliary Building isolation. The purpose of maintaining a negative pressure is to prevent unfiltered outleakage. The capacity of the system is 9000 CFM/train.

The Emergency Gas Treatment System (EGTS) is used to filter radioactive particulates and iodine from the exhaust airstream and maintain the Reactor Building annulus at a negative pressure with respect to outdoors. It is an ESF filter system in standby and only operated occasionally for testing. It performs its function following a LOCA. The purpose of maintaining a negative pressure is to prevent unfiltered outleakage. The capacity of the system is 4000 CFM/train.

The Containment Purge (CP) System is used to filter radioactive particulates and iodine from the exhaust airstream before it is released to the atmosphere. It is a non-ESF filter system that is operated continuously during outages and occasionally during plant power operation. It is required during purging activities while at power and during refueling operations although no credit is taken for the filters in calculations of offsite doses. The capacity of the system is 14000 cfm/train.

The Control Building air cleaning system is used to filter out radioactive particulates and iodine from the outdoor pressurizing airstream before its entry into the main control room. It is an ESF filter system in standby and only operated occasionally for testing. It is required for any event in which radioactive particulates and/or iodine can be released (i.e., Fuel Handling Accident, LOCA, and waste gas decay tank rupture). The capacity of the system is 4000 CFM/train.

The Post Accident Sampling Facility (PASF) Ventilation System is used when the sampling facility is utilized or following an accident. It is a non-ESF filter system and is operated for testing and when the sampling facility is being used. The PASF filters radioactive particulates and/or iodine from the exhaust airstream. The capacity of the system is 2000 CFM/train.

Investigation

The investigation utilized an integrated approach to providing an engineering basis. The six areas investigated were:

1. Test charcoal efficiency after exposure to known contaminants
2. Charcoal and its ability to adsorb contaminants
3. Other utility experience
4. Potential contaminants in paint and their release rates
5. Air change rates
6. Procedural and administrative controls

The purpose of the six areas is:

1. To corroborate charcoal's documented efficiency performance following exposure to contaminants
2. To determine the upper limit of contaminants charcoal can adsorb and still fulfill its safety function
3. To determine if the nuclear industry has a common approach
4. To determine the amount of contaminants which will become airborne in paint used
5. To determine minimum time required to purge areas of contaminants before operating ESF filter systems
6. To determine if existing controls are adequate

Test Charcoal Efficiency

Spare charcoal, at the plant site, was intentionally exposed to known quantities of paint to corroborate charcoal's documented efficiency performance following exposure to contaminants. The test setup consisted of a leak-tight enclosure (for the painting and sealing activities), a filter housing capable of containing one Type II charcoal adsorber tray (containing charcoal impregnated with TEDA and KI), and a fan. The test setup was interconnected with flexible ducting and the fan was equipped with a damper to adjust airflow.

The materials chosen for the testing were the two types of paint most commonly used at the plant and the RTV most commonly used at the plant. Five tests were performed with paints and two tests were performed with RTV. This charcoal was then tested in accordance with technical specifications requirements to determine the charcoal efficiency. Testing was conducted in early 1989 in accordance with ASTM D 3803-1979. Test results are contained in Table 1.

The acceptance criteria for charcoals at SQN varies from 90 percent for CP to 99.875 percent for EGTS. The test results show that the charcoal still met all acceptance criteria. The most severe test was PNT-4 using a highly volatile paint. This released approximately 8.76 lb. of volatiles onto the charcoal. Using 55 lbs. of charcoal per tray, this is a percentage of (8.76/55) x (100)) = 15.93 percent. Thus, the testing supports previous literature published and the present limits of the TVA procedure (1/2 of 1 percent by weight).

Table 1 Testing Results

Test #	Material	Contaminants pounds	Charcoal pounds	Percent by Weight	Charcoal Efficiency percent
PNT 1	Low volatile paint	1.08	55	1.96	>99.9
PNT 2	Low volatile paint	2.16	55	3.93	>99.9
PNT 4	Highly volatile paint	8.76	55	15.93	>99.9
PNT 5	Low volatile paint	1.08	55	1.96	>99.9
Seal 1	RTV	0.01	55	0	>99.9
Seal 2	RTV	0.59	55	1.07	>99.9

Test PNT-3 was not performed.

The testing indicated that the charcoal met all acceptance criteria for iodine efficiency. The testing indicated that charcoal can still perform adequately after being exposed to fumes from painting and sealing activities.

Charcoal and Its ability to Adsorb Contaminants

Industry-issued papers were researched and used to determine the amount of material that a charcoal filter can adsorb and still meet its iodine efficiency requirements. Published information indicates that unimpregnated charcoal can handle approximately 6.8 percent to 11.5 percent of its weight, in contaminants, before it will fail its iodine retention test[9]. Other information indicates that charcoal will maintain its efficiency with contaminant loadings of 5 to 30 percent[6, 7]. The papers also indicated that water vapor in conjunction with the hydrocarbon contaminants degrades the charcoal at the highest rate[10]. It also indicated that charcoals impregnated with both TEDA and KI have the greatest resistance to the effects of water vapor and hydrocarbon contaminants[10]. SQN charcoal is purchased with both TEDA and KI. Thus, it follows that a conservative exposure level for known contaminants should be chosen at 5 percent or less by weight of the charcoal.

Other Utility Experience

Experience of utilities, other than TVA, was used in developing the direction and type of controls that are now in place at SQN. Engineers at other nuclear facilities around the country were contacted to determine how they address protecting ESF (and non-ESF) filters from contamination by hydrocarbons which are formed during painting[1,5,11]. It is interesting to note that in a 1989 survey 54 percent of the utilities contacted allowed some exposure of their charcoal filters to paint fumes before a test was required. A 1996 survey indicates that 75 per cent of utilities now allow some exposure (some as much as 2500 square feet)[14]. Industry practices to protect charcoal adsorbers from contamination include the use of painting permits and coordination of use of cleaning solvents and sealing materials with the testing and running of air cleaning systems. No plant contacted allowed any intentional exposure of charcoal filters to paint or other hydrocarbon fumes. Other methods of controlling painting activities included:

a. Painting in tents using a portable sacrificial charcoal bed. The sacrificial charcoal was in service until the paint had cured.
b. Run the normal ventilation system to remove paint fumes from the area prior to operation of a filter system.
c. Allow painting and if the system is operated then test the system within the Technical Specification time limits.

Potential Contaminants in Paint and Their Release Rates

There are many different materials used at a nuclear plant. Material data sheets, supplied by the paint (or chemical) manufacturer were used to determine the amount of material that can offgas from paints as the paint cures. This information can be used to determine the level of exposure of a charcoal filter to contaminants. The materials that were evaluated were the paints and sealants that were most commonly used. The Material Safety Data Sheets (MSDS) for the most common materials used were then obtained as the amount of volatiles are shown in the MSDS. The paints and sealants used range from a high of about 60 percent volatile (8.76 pounds of solvent per gallon of paint) to a low of about 4 percent volatile (approximately 0.54 pounds of solvent per gallon of paint). The paints evaluated have short cure times, however some paints require cure times of approximately 20 hours.

Air Change Rates

Air change rates are useful in determining the time required to remove paint fumes from an area prior to operating a filter system that serves the area. Air changes are easily calculated by using building volumes and ventilation air flow rates. Air change rates for the various elevations of the auxiliary building ranged from 1.9 air changes per hour (ACH) to 6.6 ACH. The air changes for the reactor building were considerably less; however the ACH for the reactor building is moot as all ventilation air must be exhausted through the containment purge air filters.

The ACH can then be used to determine the minimum time for ventilation system operation following completion of paint curing (or other activity that releases hydrocarbons) to remove fumes. ASTM E741 - 83 can be used to determine the time frame. This ASTM standard uses the following equation [eq 1] to determine dilution of a gas:

$$C = Co \exp(-It) \qquad (1)$$

where

C = fume concentration at time t
Co = fume concentration at time (t) = 0 percent
I = ACH, and
t = time, hrs.

Therefore to determine the time required to reduce the concentration of fumes (i.e., hydrocarbons) in the air by 95 percent, the following is calculated:

$$C = 1.0 - 0.95 = 0.05$$
$$Co = 1 \text{ or } 100\%$$
$$I = 1.9 \text{ ACH} \quad \text{chosen as the most conservative value}$$

solving for t renders

$$C = Co \exp(-It)$$
$$0.05 = 1.00 \exp(-1.9t)$$
$$1.58 \text{ hours} = t$$

For conservatism, the number is rounded to two hours and then a margin of two hours is added. This then results in a four hour run time for the ventilation system following completion of the activity.

Procedural and Administrative Controls

Procedures at the plant control activities by requiring permits for activities that can release airborne hydrocarbons into zones served by ESF (and non-ESF) air cleaning systems. Review of the earlier version of the TVA procedure, AI-29, "Aromatic and Ester Hydrocarbon Release Permit" indicated it was adequate for its intended function. The procedure prevented any activities whenever filter systems were operating or could potentially operate. This presented the plant with a multitude of scheduling and coordination problems for the smallest of activities. An example is the painting of a weld on a baseplate (approximate total area of one square foot). This activity would be required to be scheduled several weeks in advance and still may have been cancelled on the day it was scheduled. The permits are issued on a daily basis and require Operations notification prior to issuance. A 24-hour waiting period was required following any activity that released fumes prior to operating any filter system. Review of the permits indicated that the vast majority of permits issued were for areas approximately 10 square feet or less. The permit process did not allow for evaluations of the activity should a filter system be operated while a painting activity was ongoing. Other areas noted for improvement in the permit process were the need for:

a. Clearer identification of the areas where permits were required
b. Identification of areas outside the building that could have an effect on the filters (some filters took suction from the outside atmosphere)
c. Identification of the vent systems operated during any activity

Results

Testing of Charcoal

Testing performed at SQN corroborated industry information on charcoals and the effects of contaminants. The tested charcoal was able to meet required efficiencies after being exposed to as much as 15.9 percent of its weight in contaminants. The tests were not all inclusive but did coincide with previous papers published.

Charcoal and Its ability to Adsorb Contaminants

Previously it was noted that a conservative level of contaminants is 5 percent by weight of charcoal. Based on a 5 percent by weight ratio, the following systems would then have the capacities indicated. Note that there is approximately 55 pounds of charcoal per charcoal tray and three trays per 1000 CFM. Each value is based on one train of equipment.

For conservatism, a safety factor of 10, below the maximum permissible level of contaminants, is used to assure that the charcoal shall not be exposed to amounts of contaminants that can degrade its performance. This accounts for normal aging and spurious system starts that may increase exposures of charcoal to contaminants. Also, with the potential questions of obtaining accurate test results using ASTM D 3803-79, the additional conservatism will help ensure that charcoal will not be exposed to excessive amounts of contaminants. Therefore, the maximum amount of documented exposure to a charcoal filter, conservatively chosen, is 0.5 percent of the weight of the charcoal.

A sample calculation to determine the amount of contaminants permitted on the PASF is:

Procedural Limits, lbs = (2000 cfm) (3 charcoal trays/1000 cfm) (55 lbs charcoal/tray) (.05) (1/10)
= 1.65 lbs

Results are contained in Table 2.

Table 2 Exposure Limits for Charcoal

System	Airflow CFM	Charcoal weight pounds	Maximum Amount of Contaminants pounds	Procedural Limits pounds
ABGTS	9000	1485	74	7.4
EGTS*	4000	660	33	3.3
CP	14000	2310	115	11.5
Cont. Purge	4000	660	33	3.3
PASF	2000	330	16	1.6

*Has two banks of charcoal. Calculation is based on one bank.

Other Utility Experience

The nuclear industry does have a consistent approach in that it does protect ESF charcoal filters in air cleaning systems. However, the degree of protection varies with the utility as seen by the fact that utilities will allow exposure of filters to fumes (some areas as much as 2500 square feet). Incorporated into the procedure is an allowance of up to 10 square feet of area which can be painted (or equivalent area for solvents or other chemicals) without the need for a permit. This is a consistent approach with other utilities in that a small amount of exposure (fumes equivalent to 10 square feet of painted surface area) does not automatically require an efficiency test be performed. Determination of this value (10 square feet) was based on an evaluation of the square foot areas designated on permits issued prior to this allowance. Another feature incorporated into the procedure is use of a tent with a sacrificial bed of charcoal. Painting or other activities are performed inside the tent. Air is exhausted from the tent and passed through the sacrificial charcoal filter to remove contaminants.

Potential Contaminants in Paint and Their Release Rates

It has been previously stated that 20 hours is required to cure paints. Many of the paints used cure in a time frame less than the 20 hours. Solvents evaporate immediately (i.e., in a few minutes) and would be removed from the area by the ventilation system. With the weight of solvents known, conservatively assuming that all solvents are released from the paints, and knowing the coverage area of the paints Table 3, "Permissible Level of Contaminants" is developed. The table shows the relationship between the maximum allowable contaminants and surface area for paints and sealants and the volume for solvents. The paint weights are based on weight of volatiles offgased from paints. Sealants are taken to be the same as low volatile paints.

TABLE 3 Permissible Level of Contaminants

System	Maximum Amount of Contaminants pounds	Maximum Area for Painting Highly volatile Paints, FT2 Note 1	Maximum Area for Painting Low Volatile Paints, ft2 Note 2	Maximum amount of solvent gallons Note 3
ABGTS	7.4	125	685	0.9
EGTS	3.3	55	300	0.4
CP	11.5	200	1050	1.4
Cont. Bldg	3.3	55	300	0.4
PASF	1.6	28	150	0.2

Note 1. Area = (lb. contaminants/8.76 lb/gal) (150 ft2/gal)
Note 2. Area = (lb. contaminants/0.54 lb/gal) (50 ft2/gal)
Note 3. Volume = (lb. contaminants/8 lb/gal)

Air Change Rates

The minimum time to run the Auxiliary Building ventilation is 24 hours. The 24 hours is based on 20 hours for the majority of hydrocarbons to offgas (95 percent) and 4 hours to purge the building. The minimum time to run the ventilation system for solvents is 4 hours after use of the solvent has been discontinued; however for simplicity, the air cleaning systems are not run for 24 hours following any activity. If the system is operated, an evaluation of the effects of the activity is required.

Procedural and Administrative Controls

The improvements in the administrative controls implemented in the work control process are:

a. allowing up to 10 square feet of surface to be painted, cleaned, or weld inspected without the use of a permit
b clearly identifying areas that require permits for the protection of filters
c. requiring an evaluation of the effects of the activity should a filter system be operated during the performance of that activity
d. requiring that an exposure log be kept to record the cumulative amount of exposure for each system
e. defined the use of tents for controlling activities that may release hydrocarbons
f. establishing limits for exposure of the filters
g. integrating Operators in the permit process

Filters are never intentionally exposed to hydrocarbon fumes. Activities are scheduled to operate systems at times when painting or other hydrocarbon releasing activities have ceased. For exposures above the acceptable levels, the unit (charcoal) will be tested, and any further exposure will be prevented or require additional charcoal tests. Prior to making the procedural changes, SQN was issuing approximately 900 permits a year. The number of permits issued per year has dropped to less than 100. An exception to never intentionally exposing filters to contaminants is the Containment Purge system. This system operates during refueling outages to ventilate containment. There is no practical way to protect the filters, and as a result, charcoal tests are scheduled following the outage. The current permit in use at SQN is contained in Attachment 1.

Conclusions

The TVA Sequoyah testing results supported previous industry papers addressing hydrocarbon effects on charcoal. The results indicated charcoal can meet its required efficiencies after exposure to hydrocarbons. Industry information indicates that charcoal may start having lowered efficiencies with as little as 5 percent, by weight, in contaminants absorbed by the charcoal. SQN has chosen 0.5 percent as its administrative limit for charcoal contaminants. The administrative controls, implemented as a result of this effort, have been well received by the plant (craft, operations, management, and engineers) and has not allowed any excessive exposures of contaminants with the filters.

References

1. Sequoyah Nuclear Plant Condition Adverse to Quality Report, CAQR SOP890064, Revision 0.
2. Administrative Instruction AI-29, "Aromatic and Ester Hydrocarbon Release Permit" (replaced by Site Standard Practice SSP-7.4, "Work Permits")
3. Regulatory Guide 1.52, "Design, Testing, and Maintenance Criteria for Atmospheric Cleanup System Air Filtration and Adsorption System Units of Light-Water-Cooled Nuclear Power Plants"
4. Regulatory Guide 1.140, "Design, Maintenance, and Testing Criteria for Normal Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants"
5. "Diablo Canyon Power Plant Guidelines for Protection of Carbon Filters" by Ginter, W., paper submitted at the 19th DOE/NRC Nuclear Air Cleaning Conference.
6. "Manufacture, Structure, Properties, and Application in the Nuclear Industry A Presentation for ASTM-D33," April 1986, Aimsworth, D., Sutcliffe Speakman, Inc. Carbon has a capacity of 5 percent-30 percent weight before being exhausted (and therefore failing its test).
7. "Evaluation and Control of Poisoning of Impregnated Carbons Used for Organic Iodide Removal" by Kovach, J. L., and Rankovic, L., paper submitted at the 15th DOE Nuclear Air Cleaning Conference. One case of failed charcoal due to 5 percent by weight of organics present. Testing indicated charcoal can hold up to 260 mg/g (26 percent) organics and still pass testing.
8. Sequoyah Nuclear Plant Site Standard Practice (SSP) 7.4, "Work Permits"
9. KFK 2449 "Iodine Filters in Nuclear Power Stations," Wilhelm, J. G., April 1977. This report indicated that iodine efficiencies were lowered drastically with solvent loadings varying from 6.8 percent to 11.5 percent. The paper noted that impregnated charcoal maintains higher efficiencies when exposed to solvent vapors than does unimpregnated charcoal.
10. "Charcoal Performance Under Accident Conditions in Light-Water Reactors," NUREG/CR-3990 (NRL Memo Rpt 5528), March 1985. This report indicates that charcoal impregnated with TEDA and KI exhibit less penetration than other charcoals. This report also indicates the adverse synergistic effect of high moisture and hydrocarbon contaminants degrading the charcoal when exposed at the same time.
11. David Besse, Procedure ISG-15, Rev. 1. Procedure allows 50 ft2 exposure. There must be three air changes before system runs.
12. ASTM E 741-83 "Standard Test Method for Determining Air Leakage Rate By Tracer Dilution"

13. Sequoyah Nuclear Plant Technical Specifications, T.S. 3.6.1.8, EGTS; 3.7.7, CREVS; 3.7.8 and 3.9.12, ABGTS

14. LIS Survey Regarding Charcoal Filters (#96077), June 10, 1996

Attachment 1

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APPENDIX C
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PAINTING, CLEANING, SEALING, AND OTHER VOLATILE HYDROCARBON USE PERMIT [C.3]

**Permit Number #____________________

**ISSUED BY____________________/__________/__________ **Vent. System Affected____________
Tech Support Date Time

NOTE: This permit is valid only for the date and location shown. The original permit is to remain with the work package. A copy of every permit is to be sent to Tech Support for exposure log entries after SOS signoff.

UNIT WORK LOCATION (BUILDING) (ELEVATION)

____ ____

Brief Description of Work:____

Material:____

***This permit starts:____________________

***This permit expires:____________________

*Volume of solvent used or area painted. Estimated__________ Actual__________
☐ Solvent
☐ Sealant
☐ Paint

Affected ventilation system operated during time this permit was in effect.
☐ YES ☐ NO

If system operated, evaluation by System Engineer; otherwise, N/A.

____________________/__________
SOS or Designee Date

____________________/__________ Evaluation Attached ☐
System Engineer Date

NOTE: Touch up painting (less than 10 square feet) or weld inspections do not require a permit.

YES	NO	CERTIFICATION
____	____	All material which may constitute a fire hazard has been removed from the area or adequately protected. Transient fire loads have been evaluated by Fire Operations and specified controls initiated per SSP-12.15, Appendix E. All firefighting equipment is available as required by the program for control of ignition sources and I have instructed my men on how a fire is to be reported.
____	____	As the Foreman (supervisor), I recognize that work areas will require reinspection for fumes which may constitute a hazard and I will personally reinspect the area at least once during the shift for which this permit is valid.

____ ______________
Responsible Foreman or Supervisor (Signed & Printed) Date

NOTE ONLY one permit is needed if using a tent. No exposure is assumed to occur to charcoal filters if a tent is used. The use of a tent still requires a permit.

* Not required if enclosures and portable charcoal filters are used.
** Completed by Tech Support. (See Table C-1)
*** The permit will be valid for one job at one location. It shall be valid for one day, three working shifts. Permits can be obtained up to three days in advance. (Exception see note)
Posting Requirements: Retain with work document during and following work.

DISCUSSION

BARROW: Did you perform a D3803-89 test?

CAMPBELL: The test conditions are 80°C and 70% RH. 70% RH is used as we have humidity control. This is in accordance with the plant technical specifications.

GOLDEN: Prior to implementing this program did you have any failures of your charcoal system test that were directly attributed to painting?

CAMPBELL: No, we did not, but our management is conservative in some of their evaluations. We have had some events from exposure to welding fumes and we have had some small electrical equipment catch fire while running the systems. In each case, we would pull a sample. We would change out the charcoal but we would pull a sample on the charcoal that we were changing out and each time the charcoal that we discarded still passed our Tech. Spec. Test. So, we have not had any failures. The only reasons that we have replaced charcoal in the past eight years, that I know of, is because of permanent sets in the gaskets that prevent us from replacing the tray after we pull the charcoal sample. We cannot pass our bypass leakage test then we change out all the charcoal in the system to maintain the same lot number in the entire system.

ROBERSON: Does the "less than 10" non-permit criterion mean that these fume exposures are not cumulatively tracked?

CAMPBELL: One of the reasons that we chose 10 ft^2 is because of the 0.5% by weight that we allow on our filter systems. Because we are not controlling below 10 ft^2, there can be exposures that occur without knowing it. So we chose an order of magnitude below what has previously been published regarding charcoal failure to allow us a margin so that we will not have to worry whether or not we should test our charcoal. Also, we have looked at the run times when this has happened and we have an ability to call up run times on all our filter systems on our plant computer. If systems have run spuriously, it will be only for 15-30 min., rarely longer than an hour. That does not always happened with containment isolation so there are factors that go into whether or not the systems are exposed. In addition to choosing 10 ft^2 we looked at number of square feet that were allowed on previous permits and the vast majority were for 3 - 4 ft^2. We also talked to our maintenance department and our chemistry people. The result was that we chose 10 ft^2 as a reasonable value. It has been very well received.

ROBERSON: Does the paint accumulation log only update based on the system being in service?

CAMPBELL: Yes. The systems have isolation dampers and exposure can only occur when the system is running.

HARRIS: We have a painting program in which we track the volatile organic content of each of the coatings and adhesives on the filter beds. We have noticed that even when relying on only 10 ft^2 to be painted, very few coatings come out without a one gallon kit, or a five gallon kit. If that paint is still in the ventilation zone, do you still assume that the volatiles are coming out and tracking it on your charcoal loading as well?

CAMPBELL: This is a good question. What we have implemented at in our Sequoia plants is a chemical control. Again, our Rad Con people will not allow anyone to take anything into the RCA's unless they are going to use that material. So we have controls over what is taken in. If they say they intend to paint a hundred square feet but when they give the permits back to us they report only painted ten square feet, the instructions given to our maintenance people is to show the total volume of paint they took in. We then consider making an adjustment, but as a rule, we do not. What you take in you use up because what is left is rad waste. There is no way you can really prove that it is not.

GOLDEN: You said you did your testing to the 1979 or 1980 standard. I assume, because that is what your Tech Specs called for, the 80°C test. Did you also do any parallel testing to the 1989 standard or anything more stringent like a 30°C test?

CAMPBELL: No. The testing we did was several years ago, and the ASTM 89 version was not available at that time. I was aware of the controversy around 1979 and that is another reason why we chose an order of magnitude less than what the lowest recorded values were. At every step along the way we tried to be conservative in what we were doing but maintain some flexibility. We did not have any flexibility to begin with, but we wanted something reasonable that we would not have to come back and change again in three or four years. Knowing the controversies, we tried to stay very conservative on what we are doing.

CASS: Did you considered different methods of application, roller, brush, or spray? Did you take in preparation; sandblasting, grinding, what have you?

CAMPBELL: No, we did not look at different application methods. As far as grinding or chipping away the paint, that is dust and we did not consider it.

GHOSH: Did you consider the drying time of the solvent? The solvent time varies exponentially, between two and four hours during which time most of the solvent may be reduced from 100 to 50%. In four hours it may go to 10 or 5%. Using that method, did you check how much loading is taken back from the carbons?

CAMPBELL: No, we did not check into that. The way we are looking at it is that the paints will cure exponentially. Most of the offgases will occur during the first hour and then it will decrease. We look at the run times at the end of the painting activity and we assume the paint is totally cured according to what the vendors tell us on the paint. At that point, everything that is going to offgas should have offgassed. We assume 100% for the purpose of calculating run time. We say 100% is still in the area and we run four more hours. In reality, the stuff is going to be removed continuously, it is going to be less and less over a period of time and probably at the time the paint cures there is probably very, very little fume in the area.

GHOSH: Yes, 24 hours is very safe.

CAMPBELL: Definitely. It is an easy value to remember.

GHOSH: One more thing, you use 10 square feet. Did you equate it in terms of limiting the amount in terms of gallons? That is what we did.

CAMPBELL: Yes we have, but that is not covered in the paper. We did equate it when we were talking to our maintenance people. We asked what do you want, and they said square feet. We looked at high and low volatile paints (we considered sealants the same as low volatile paints) and we agreed that 10 square feet was acceptable based on the paints we use at the plant.

GHOSH: It varies with how much thickness, how many mills.

CAMPBELL: It depends on the thickness. It doesn't show in the paper, but a low volatile paint that we use is a Keylor and Long 4500 paint, for example, that will cover 64 square feet per gallon, we say it will cover 50 square feet rather than the recommended 64 square feet and we base our calculations on that number.