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Event RIDS Dist.
SP04

Event Reporting Handbook

EVENT REPORT COVER PAGE

AGREEMENT STATE

EVENT REPORT NO. _ - _ - _

DATE: October 22, 1996

TO:

Deputy Director
Office of State Programs

SUBJECT: 8/20/96 Radiography Event ~~in~~volving
NDT Services, IN, that Occurred
at Holmes Brothers, Danville, IL

STATE: Resulting in Low Dose Exposures
ILLINOIS

Signature and Title: _____

Bruce Sanza, HP

060036

Division of Radioactive Materials

IL Dept. of Nuclear Safety

NRC FILE CENTER COPY

03/16/95

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PDR STPRG ESGIL
PDR

SP-E-9



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RECIPROC. #77-00168-01

AUGUST 26, 1996 (revised 9-9-96)

ILLINOIS DEPT. OF NUCLEAR SAFETY
OFFICE OF RADIATION SAFETY
1035 OUTER PARK DR.
SPRINGFIELD, IL 62704

Post-It® Fax Note 7671

Date	10-22	# of pages	9
To	Pat LARKINS	From	BRUCE SANZA
Co./Dept	NRC/OSP	Co.	IDNS
Phone #		Phone #	
Fax #		Fax #	

ATTN: BRUCE SANZA

RE: REPORT OF HIGH EXPOSURES TO PERSONNEL DURING RADIOGRAPHY.

DEAR MR. SANZA:

PER OUR PREVIOUS TELEPHONE CONVERSATIONS, I HAVE DOCUMENTED THE
ACCIDENTAL HIGH EXPOSURE TO OUR RADIOGRAPHERS INCLUDING A
DESCRIPTION OF EVENTS, CALCULATIONS, AND SKETCHES FOR YOUR
EVALUATION.

DATE: 08-20-96

TIME: 9:20 PM

LOCATION: HOLMES BROS.
522 JUNCTION
DANVILLE, IL

PERSONNEL INVOLVED:

JOHN S. CLERC II - RADIOGRAPHER ID# 438-49-1369

RICHARD B. SAYLORS - RADIOGRAPHER ID# 311-58-8620

RADIOACTIVE ISOTOPE INVOLVED:

62 CURIES IR 192 CAPSULE #A8846 IN AMERSHAM MODEL 660B
PROJECTOR #B1022.

SURVEY METERS INVOLVED:

NDS MODEL ND-2000, S/N 15230 CALIBRATED ON 6-28-96, AND
NDS MODEL ND-2000, S/N 13239 CALIBRATED ON 7-17-96.

500 MR/HR ALARMING RATEMETERS INVOLVED:

NDS PRODUCTS MODEL RA-500, S/N'S 13096 AND 7168 CALIBRATED
ON 1-5-96.

200 MR POCKET DOSIMETERS INVOLVED:

DOSIMETER CORP. MODEL 862, S/N'S 7120134 AND 818943
CALIBRATED ON 1-3-96.

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FILM BADGES INVOLVED: LANDAUER MODEL G-1 BADGES, AUG-96
JOHN S. CLERC II: SPARE B BADGE #00079
RICHARD B. SAYLORS: BADGE #00129

DESCRIPTION OF INCIDENT:

DURING ROUTINE RADIOGRAPHY OF A WELDMENT AT THE JOBSITE LISTED ABOVE, THE RADIOGRAPHERS HAD JUST SET UP FOR THE NEXT EXPOSURE WHEN RADIOGRAPHER JOHN S. CLERC REACHED DOWN TO PICK UP HIS SURVEY METER AND NOTICED THAT THE METER WAS READING HIGH. BOTH RADIOGRAPHERS HURRIED BACK TO THE CRANK CONTROL AND CHECKED THEIR DOSIMETERS TO FIND THAT BOTH OF THEIR DOSIMETERS WERE "OFF-SCALE". MR. CLERC THEN PICKED UP THE CRANK CONTROL AND SECURED THE SOURCE INSIDE THE PROJECTOR. AS THEY DISCUSSED THE INCIDENT, BOTH RADIOGRAPHERS CAME TO THE CONCLUSION THAT THEY HAD BECOME DISTRACTED WHILE TALKING TO EACH OTHER AND HAD NOT RETRACTED THE SOURCE IN BETWEEN EXPOSURES. BOTH MEN WERE WEARING NDS 500 MR/HR RATEMETERS, BUT NEITHER RATEMETER RESPONDED WHEN THEY WALKED UP AROUND THE EXPOSED SOURCE. BOTH MEN WERE CARRYING SURVEY METERS, BUT NEITHER RADIOGRAPHER NOTICED A HIGH READING ON THEIR METER. MR. CLERC IMMEDIATELY CALLED THE RSO, MIKE THOMPSON, AND DISCUSSED THE INCIDENT. RADIOGRAPHY WAS IMMEDIATELY CEASED AND THE MEN WERE INSTRUCTED TO RETURN TO INDUSTRIAL NDT SERVICES AND LEAVE THEIR FILM BADGES FOR MR. THOMPSON TO SEND IN FOR IMMEDIATE PROCESSING. TOTAL SET-UP TIME (DURING WHICH BOTH MEN WERE WORKING CLOSE TO THE EXPOSED SOURCE) WAS ESTIMATED TO BE FOUR MINUTES. FILM BADGE RESULTS FROM IMMEDIATE PROCESSING SHOWED THAT MR. SAYLORS (WHO WAS PLACING FILM INSIDE THE VESSEL) RECEIVED A DDE/EDE/SDE DOSE OF .290 REMS. SINCE MR. SAYLORS WAS THE FURTHEST AWAY FROM THE EXPOSED SOURCE, WE BELIEVE THAT HIS DOSE IS ACCURATE AND THEREFORE NO FURTHER CALCULATIONS ARE NECESSARY TO ACCOUNT FOR THE FACT THAT THE SOURCE WAS INSIDE THE COLUMNATOR. HOWEVER, MR. CLERC WAS WORKING NEXT TO THE EXPOSED SOURCE WITH THE COLUMNATOR LOCATED APPROX. TWO FEET ABOVE HIS HEAD FOR PART OF THE TIME AND ALSO WITH THE COLUMNATOR AT APPROX. "HIP" LEVEL FOR THE REMAINDER OF THE TIME. EVEN THOUGH MR. CLERC'S HEAD WAS THE PART OF THE "WHOLE BODY" CLOSEST TO THE COLUMNATOR, AS HE APPROACHED THE AREA, HE QUICKLY REMOVED THE SOURCE STAND FROM THE LADDER AND SET IT ON THE FLOOR SO THAT THE COLUMNATOR WAS THEN AT "THIGH LEVEL". THE COLUMNATOR REMAINED IN THIS POSITION FOR THE MAJORITY OF THE EXPOSURE, SO WE BELIEVE THAT THE DOSE TO MR. CLERC'S HEAD WAS ACTUALLY LESS THAN THE DOSE TO HIS FILM BADGE (WHICH WAS WORN AT WAIST LEVEL). DURING THE SET-UP, THERE WERE TIMES WHEN HIS HANDS WERE MOVED DIRECTLY IN FRONT OF THE UNCOLUMNATED BEAM. SINCE HE WAS WEARING HIS DOSIMETRY AT WAIST LEVEL, WE HAVE DOCUMENTED FURTHER CALCULATIONS BELOW TO ACCOUNT FOR THE ADDITIONAL EXPOSURE THAT HE MAY HAVE RECEIVED AND TO ACCOUNT FOR PART OF THE FILM BADGE DOSE BEING SHIELDED BY THE BODY.

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RATE OF EXPOSURE FOR UNCOLLUMNATED 62 CURIE IR 192 SOURCE:

$$\begin{aligned} 5.2 \text{ R/HR/Ci @ 1' X } 62 \text{ Ci} &= 322 \text{ R/HR @ 1' } \\ &= 5.4 \text{ R/MINUTE @ 1' } \\ &= .090 \text{ R/SEC @ 1' } \end{aligned}$$

$$\text{COLLUMNATED (4 HVL) } = 6 \text{ MR/SEC @ 1'}$$

FROM TIME/MOTION EVALUATION, WE SUBMIT THE FOLLOWING ESTIMATES:
THE LARGEST DOSE WAS RECEIVED BY MR. CLERC'S HANDS:

$$\begin{aligned} 5 \text{ SEC. EXP. @ 6" (DIRECT BEAM)} &.358 \text{ R/SEC X } 5 \text{ SEC} = 1.79\text{R} \\ 5 \text{ SEC. EXP. @ 4" (COLLUMNATED)} &.050 \text{ R/SEC X } 5 \text{ SEC} = .250\text{R} \\ 3 \text{ SEC. EXP. @ 2" (COLLUMNATED)} &.201 \text{ R/SEC X } 3 \text{ SEC} = .603\text{R} \\ 10 \text{ SEC EXP. @ 12" (COLLUM.)} &5.625 \text{ MR/SEC X } 10 \text{ SEC} = .056\text{R} \\ 10 \text{ SEC. EXP. @ 24" (COLLUM.)} &1.40 \text{ MR/SEC X } 10 \text{ SEC} = .014\text{R} \\ &\underline{2.713\text{R}} \end{aligned}$$

*PLUS ADDITIONAL DOSE TO HANDS FROM DDE DOSE (FILM BADGE) +2.565R

TOTAL EXTREMITY DOSE (SDE) TO HANDS =5.278R

* FIGURED AS FOLLOWS:

THE DDE FROM FILM BADGE WAS .670 REMS. SUBTRACT THE CUMMULATIVE DOSIMETER READINGS FOR PREVIOUS EXPOSURES IN AUG.-96. THIS YEILDS A FIGURE OF .570 REMS DDE ASSIGNABLE TO THE INCIDENT. WE ALSO ESTIMATE THAT MR. CLERC HAD HIS BACK TURNED TO THE EXPOSED SOURCE APPROX. 50% OF THE TIME WHICH MEANS THAT THE FILM BADGE WAS BEING SHIELDED BY THE REST OF HIS BODY. USING 3 HVL FOR WATER (EQUIV. TO BODY - APPROX. 7.50"), WE FIND THAT MR. CLERC'S BODY PROVIDED A SHIELDING FACTOR OF 3 HVL OF WATER FOR APPROX. 50% OF THE EXPOSURE. THE DDE ASSIGNABLE TO THE EXPOSURE IS ESTIMATED AS FOLLOWS:

$$\begin{aligned} &.670 \text{ REM DDE FROM FILM BADGE FOR AUG.-96} \\ &-.100 \text{ REM DDE FOR DAILY DOSIMETER READINGS FROM} \\ &\quad \text{OTHER GAMMA JOBS DURING THE MONTH.} \\ &\underline{.570 \text{ REM DDE FROM INCIDENT.}} \end{aligned}$$

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50% OF THIS DOSE WAS
DIRECT TO FILM BADGE.
.570 X 50% = .285 REM DDE

50% OF THIS DOSE WAS THRU
3 HVL OF THE BODY (7.50")

.285 REM DDE
X 2 1 HVL
.570 REM DDE
X 2 2 HVL
1.140 REM DDE
X 2 3 HVL
2.280 REM DDE

.285 REM DDE
+ 2.280 REM DDE
2.565 REM DDE TOTAL DOSE FROM EXPOSURE

MR. CLERC'S WHOLE BODY DDE DOSE OF 2.565 REMS IS ESTIMATED FROM THE FOLLOWING STEP-BY-STEP MOVEMENTS:

1. WALKING UP TO THE SOURCE STAND (ON LADDER), LIFTING SOURCE STAND FROM LADDER AND PLACING STAND ON FLOOR:
(EXPOSURE TO FRONT OF BODY)
15 SECONDS @ 24" (COLLUMNATED) = .015 REM DDE
2. CLIMBING UP LADDER, REMOVING FILM IDENTIFICATION, AND CLIMBING DOWN (EXPOSURE TO BACK SIDE OF BODY - 3 HVL):
20 SEC. @ 36" (UNCOLLUMNATED) = .200 REM DDE
3. WALKING OVER TO TABLE TO CHANGE FILM ID:
(EXPOSURE TO BACK SIDE OF BODY - 3 HVL)
45 SEC. @ 6 FEET (COLLUMNATED) = .009 REM DDE
4. CLIMBING BACK UP LADDER, TAPING FILM ID TO PART, AND CLIMBING DOWN (EXPOSURE TO BACK SIDE OF BODY - 3 HVL):
20 SEC. @ 36" (UNCOLLUMNATED) = .200 REM DDE
5. PULLING LADDER INTO POSITION FOR NEXT EXPOSURE, PICKING UP SOURCE STAND AND PLACING ON LADDER, ADJUSTING CROSSBAR, MEASURING DISTANCE, MINOR ADJUSTMENTS, TURNING TO PICK UP SURVEY METER, SEEING HIGH READING ON METER AND RUNNING BACK TO CRANK HANDLE:
(EXPOSURE TO FRONT OF BODY)
30 SEC. @ 24" (COLLUMNATED) = .042 REM DDE
(EXPOSURE TO FRONT OF BODY)
20 SEC. @ 16" (UNCOLLUMNATED) = 1.000 REM DDE
TOTAL ESTIMATE = 1.466 REM DDE

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THIS STEP-BY-STEP DOSE CALCULATION DOES NOT EQUAL THE SAME DOSE AS CALCULATED AT THE TOP OF PAGE 4 (2.565 REM DDE), BUT WE BELIEVE THAT OUR CALCULATIONS ARE AS CLOSE AS WE CAN ESTIMATE. THE DIFFERENCE IS PROBABLY DUE TO THE AMOUNT OF TIME THAT WE ESTIMATED THAT MR. CLERC WAS EXPOSED FROM THE BACK SIDE WHEN ACTUALLY, HE MAY HAVE BEEN "PARTIALLY TURNED TOWARDS" OR "PARTIALLY TURNED AWAY FROM" THE SOURCE ON MANY OCCASIONS. ALSO, WE ARE ASSUMING THAT WHEN MR. CLERC WAS STANDING EITHER TO THE SIDE OF THE COLLUMNATOR, OR BEHIND THE COLLUMNATOR, THAT HE WAS RECEIVING THE FULL 4 HVL SHIELDING FACTOR OF THE COLLUMNATOR. IN REALITY, HE WAS PROBABLY NOT RECEIVING THE FULL 4 HVL SHIELDING DUE TO SCATTERING OFF OF THE VESSEL AND THE FLOOR.

THE NEXT MORNING AFTER THEIR RETURN, I TESTED BOTH OF THEIR NDS RATEMETERS BY PLACING THEM IN THE GAMMA CELL NEXT TO THE GUIDE TUBE AND MAKING EXPOSURES. NEITHER UNIT RESPONDED. AFTER TESTING THESE UNITS, I PROCEEDED TO TEST THE OTHER SPARE RATEMETERS IN THE GAMMA CELL AND THERE WAS ONE MORE UNIT THAT DID NOT RESPOND TO RADIATION. ALL OF THESE RATEMETERS CHECKED OUT OK DURING THE DAILY INSPECTION. THEY "BEEPED" WHEN THEY WERE TURNED ON, AND GAVE A CONTINUOUS "BEEP" WHEN THE BATTERY CHECK WAS PRESSED. UNLESS YOU DIRECT US OTHERWISE, I AM GOING TO SEND ALL THREE UNITS BACK TO THE FACTORY TO ESTABLISH CAUSE OF FAILURE.

TO DATE, WE HAVE HAD SEVERAL MEETINGS WITH THE RADIOGRAPHERS INVOLVED IN THE INCIDENT. AS CORRECTIVE ACTION, I WILL BE HAVING SPECIAL SAFETY MEETINGS WITH ALL GAMMA PERSONNEL INCLUDING TRAINEES TO DISCUSS THE ENTIRE INCIDENT, CARELESS MISTAKES BY THE RADIOGRAPHERS, EQUIPMENT MALFUNCTIONS AND REVIEW OF PROPER SURVEYING TECHNIQUES. I ALSO WILL BE IMPLEMENTING A SEMI-ANNUAL CALIBRATION OF ALL RATEMETERS TO VERIFY RESPONSE TO RADIATION (400 TO 600 MR). THIS INCIDENT REPORT WILL BECOME PART OF OUR ANNUAL "PERIODIC TRAINING" WHICH INVOLVES ALL RADIOGRAPHERS AND ASSISTANTS.

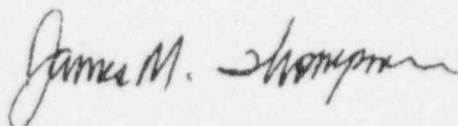
IN SUMMARY, I BELIEVE THAT WE WERE VERY FORTUNATE THAT THE DDE DOSES TO BOTH RADIOGRAPHERS WERE SO LOW MAINLY BECAUSE OF SHORT SET-UP TIMES BETWEEN SHOTS. IF MR. CLERC HAD BEEN SHOOTING SOMETHING THAT REQUIRED A LONG SET-UP TIME, OR IF HE HAD REMOVED THE COLLUMNATOR BEFORE THE NEXT EXPOSURE TO SHOOT A CIRCUMFERENTIAL WELD, THE RESULTS COULD HAVE BEEN MUCH WORSE. PLEASE REFER TO THE ATTACHED SKETCH WHICH SHOWS GENERAL MOVEMENTS AND LOCATIONS OF EQUIPMENT AND PERSONNEL.

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I STILL BELIEVE THAT WE HAVE A SOUND RADIATION SAFETY PROGRAM AT THIS COMPANY, AND I BELIEVE THAT THE PERSONNEL PERFORM THEIR EXPOSURES IN A SAFE MANNER, BUT OBVIOUSLY I AM VERY UPSET AND EMBARRASSED BY THIS WHOLE SITUATION.

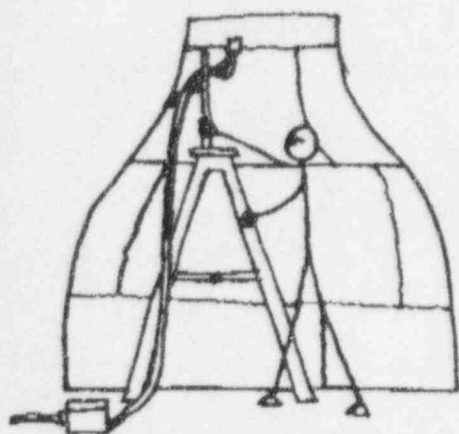
PLEASE CONTACT ME IF YOU HAVE ANY FURTHER QUESTIONS OR CLARIFICATIONS ON THIS REPORT.

RESPECTFULLY SUBMITTED,

A handwritten signature in cursive script, reading "James M. Thompson".

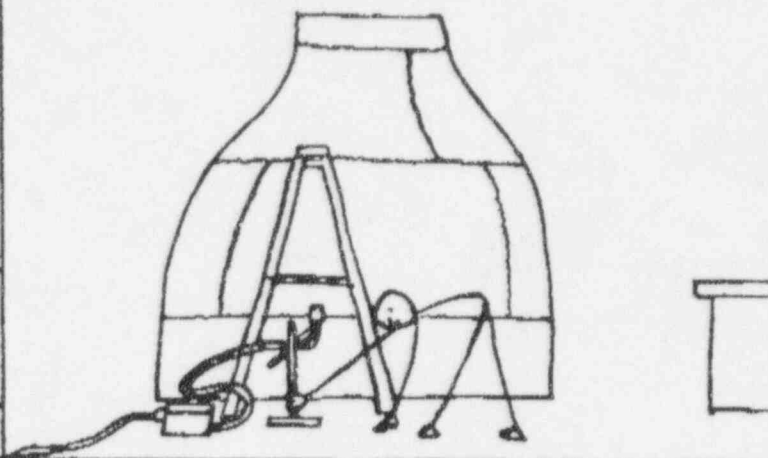
JAMES M. THOMPSON, RADIATION SAFETY OFFICER

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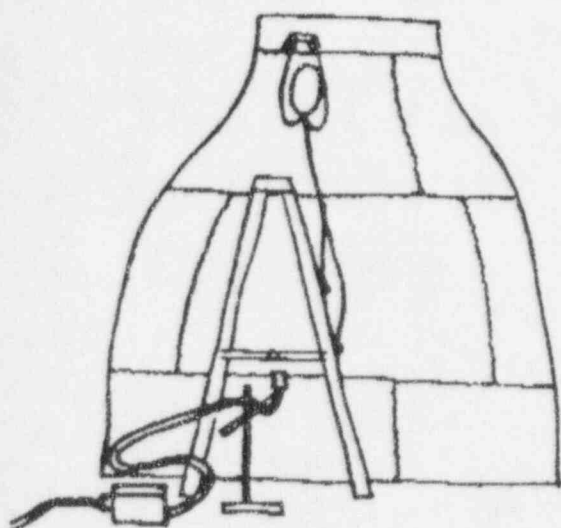


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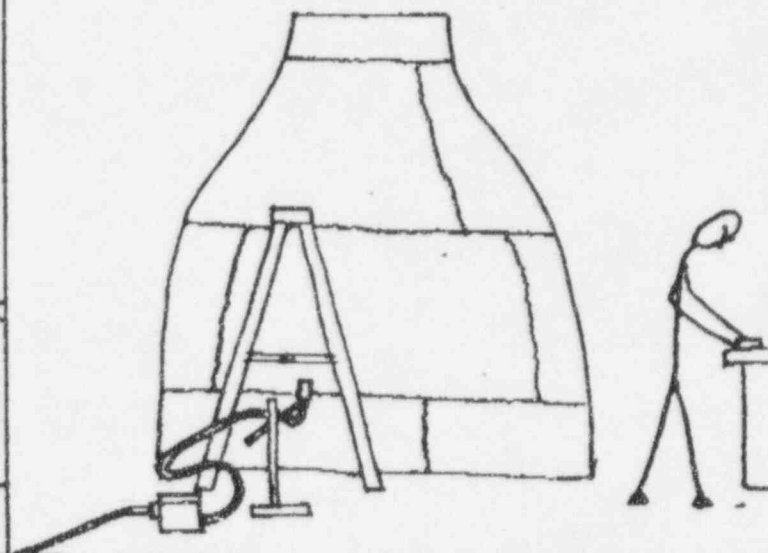
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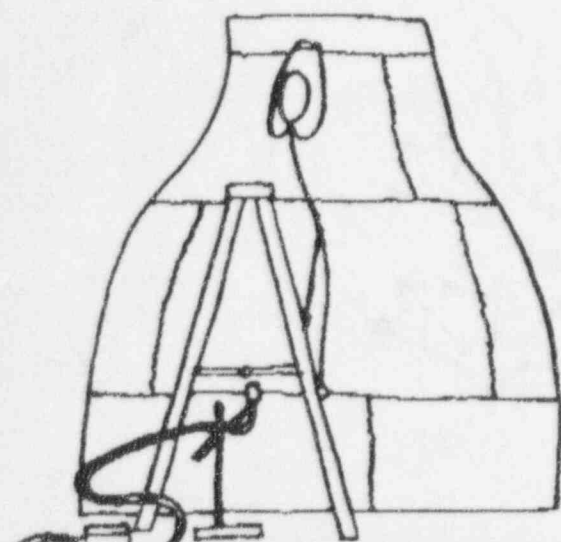
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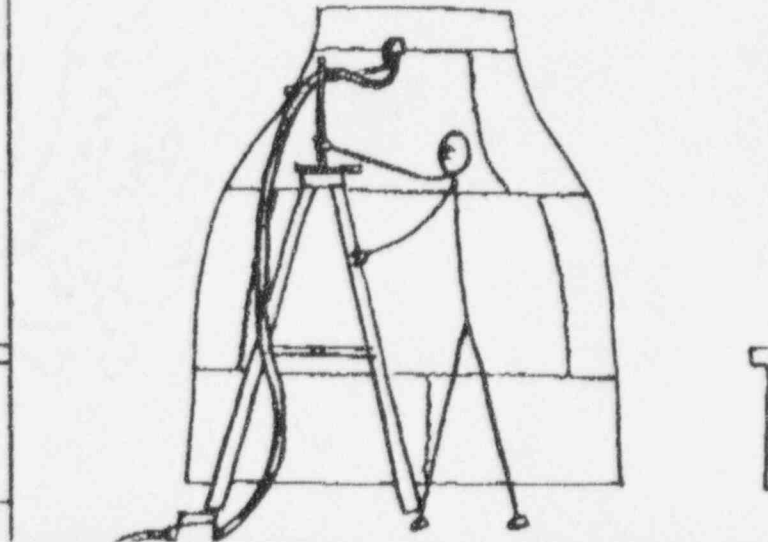
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6



DESCRIPTION OF EVENTS BY JOHN S. CLERC II

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On Tuesday, August 20, 1996, Richard Saylors and I were assigned to do Radiography on a part at Holmes Brothers in Danville, IL. After receiving the assignment information, we proceeded up our 2 mr/hr boundary and began the radiography. During several exposures Richard and I were talking. After one such exposure, I became distracted enough with the conversation that I made a detrimental mistake which unnecessarily endangered the health and safety of my assistant (Richard) and myself. Neglecting to retract the source to a "safe" position; I proceeded to walk up to the part with a survey meter. Not properly observing the meter I set it down in front of the "camera", removed the Pillstand from the Ladder, walked 10-15 ft. away to change the ID, moved the ladder, replaced the ID and Pillstand, aligned the collimator for the next exposure. During this time Richard was inside the part placing film. Neither 500 mr audible rate alarm "chirped" during this time. When retrieving the survey meter from in front of the "camera" to make the next exposure is when I noticed a higher reading. (Richard was already at the 2mr/hr boundary). I rushed to the crank handle and cranked. After securing the source I checked my 200mr/hr dosimeter and instructed Richard to do the same; we were both "offscale". We disconnected the crank and source tube and locked the camera. We then called Mike Thompson (INDTS RSO) and informed him of the situation and returned to our shop. Richard and I were fortunate that our over-exposure was not greater than it was. This is the first time in my 6 year career as a radiographer that I have made such a grave error; and this incident has reiterated the importance of maintaining focused attention on the work and surveys I perform.



John S. Clerc II

DESCRIPTI OF EVENTS BY RICHARD B. SAYLOR

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TUS. 8-20-96 STEVE AND I ARRIVED AT HOLMS BROS. IN DANVILLE ILL. WE RECEIVED OUR WORK ORDERS AND STARTED WORK IN THE AREA WE NORMALLY USED FOR THIS OPERATION. WE SET OUR 2 MR. BOUNDARY AND WE STARTED MAKING EXPOSURES TO WELDS # 1 THRU WELD #5. AT WELD #6 WE SET UP THE EXPOSURE AND CRANKED OUT THE SOURCE SETTING THE TIMER.

AT THIS TIME WE STARTED TALKING. WHEN THE EXPOSURE WAS READY TO CRANK BACK IN WE CONTINUED TALKING AS WE WALKED UP TO THE CRANK. (THIS IS NOT NORMAL. I WOULD USUALLY STAY AT THE 2 MR. UNTIL THE SOURCE HAS BEEN CRANKED IN.) WE BOTH CARRIED OUR SURVEY METER PAST THE CRANK AT WHICH POINT I SET MINE ON A NEARBY TABLE WITHOUT LOOKING AT IT OR WITHOUT READING IT PROPERLY. I THINK STEVE THEN SET HIS BY THE CAMERA, EITHER NOT LOOKING AT IT OR NOT READING IT PROPERLY. AFTER SETTING THE SURVEY METER DOWN I CLIMBED IN THE PART, PLACED THE FILM FOR EXPOSURE #7 AND REMOVED THE FILM FROM #6. I THEN CLIMBED BACK OUT OF THE PART AND MOVED BACK TO THE 2 MR. BOUNDARY. AFTER SETTING HIS METER DOWN STEVE MOVED THE SOURCE STAND FROM THE LADDER TO THE FLOOR. REMOVING THE ID, CHANGING IT AND PLACING IT ON TO #7, HE MOVED THE LADDER IN POSITION AND REPLACED THE SOURCE STAND ON TOP. POSITIONED IT FOR THE EXPOSURE AND MOVED BACK TO CRANK OUT THE SOURCE. AT THIS POINT HE REALIZED WITH GREAT SURPRISE THAT IT HAD NOT BEEN CRANKED IN. HE CRANKED THE SOURCE IN VARY RAPIDLY AND LOOKED AT HIS DOSIMETER TELLING ME TO DO THE SAME. WE WERE BOTH OFF SCALE.

WE CALLED THE RSO SO THAT HE WOULD BE AWARE OF THE PROBLEM AND WOULD TAKE ACTION TO HAVE THE FILM BADGES DEVELOPED. HE WOULD HAVE TO MAKE ARRANGEMENTS TO HAVE THE WORK COMPLETED BY ANOTHER TEAM, AS WE WERE TO PACK UP AND RETURN TO THE SHOP. ON THE WAY TO THE SHOP WE REMEMBERED THAT THE FILM FOR SHOT #7 WAS STILL ON THE PART. IT WOULD TELL US SOMEWHAT OF THE AMOUNT OF RADIATION WE HAD BEEN EXPOSED TO. AFTER RETURNING TO HOLMS WE RETRIEVED THE FILM, DEVELOPED THE FILM AND THE IMAGE WAS VARY LIGHT. IT WAS THEN CLEAR THAT THE SOURCE HAD REMAINED IN THE CALUMNIATOR. THIS WAS SOME RELIEF A SMALL SUM.

THE NEXT MORNING THE 500 MR. RATE ALARM STEVE USED AND THE ONE I HAD USED WAS TESTED AND NEITHER ONE RESPONDED AT ALL. THE FILM BADGES WERE SENT OFF VIA FED EX. STEVE AND I BOTH REPORTED OUR ACCOUNTS OF THE NIGHT TO THE RSO.

AFTER RECEIVING THE FILM BADGE REPORT FROM LANDAUER I HAD RECEIVED APPROX. 290 MR. I WAS THEN ALLOWED TO RETURN TO WORK IN THE GAMMA DEPT.

IN REVIEW, THIS WAS AS IS IN MOST CASES AN OVER EXPOSURE DUE TO AN IMPROPER SURVEY.



RICHARD B. SAYLORS