$$\frac{\texttt{Store}(v,i)}{\texttt{Heap}(v,i)} \ \ (\text{H-1}) \qquad \frac{\begin{array}{c}\texttt{Update}(*,p,val)\\ \texttt{CreatedBy}(p,p')\\ \texttt{Heap}(p',*)\end{array}}{\texttt{Heap}(p',val)} \ \ (\text{H-2}) \qquad \frac{\texttt{LitAssign}(v,*,*)}{\texttt{CreatedBy}(v,v)} \ \ (\text{CBY-1})$$

$$\frac{\texttt{Node}(n,*)}{\texttt{CreatedBy}(n,n)} \ \ (\text{CBY-2}) \qquad \frac{\texttt{Store}(p,*)}{\texttt{CreatedBy}(p,p)} \ \ (\text{CBY-3}) \qquad \frac{\texttt{Update}(v,*,*)}{\texttt{CreatedBy}(v,v)} \ \ (\text{CBY-4})$$

$$\frac{\texttt{LitAssign}(v,*,*)}{\texttt{CreatedBy}(v,v)} \ \ (\text{CBY-5}) \qquad \frac{\begin{array}{c}\texttt{Move}(v,n)\\ \texttt{CreatedBy}(n,n')\end{array}}{\texttt{CreatedBy}(v,n')} \ \ (\text{CBY-6})$$

$$\frac{\begin{array}{c}\texttt{FunctionParameter}(*,*,p)\\ \texttt{CreatedBy}(v_1,p)\\ \texttt{CreatedBy}(p,v_2)\end{array}}{\texttt{CreatedBy}(v_1,v_2)} \ \ (\text{CBY-7}) \qquad \frac{\begin{array}{c}\texttt{Fetch}(v,p)\\ \texttt{CreatedBy}(p,p')\\ \texttt{Heap}(p',n)\\ \texttt{CreatedBy}(n,n')\end{array}}{\texttt{CreatedBy}(v,n')} \ \ (\text{CBY-8})$$

$$\frac{\begin{array}{c}\texttt{CallArgument}(r,i,arg)\\ \texttt{Call}(r,f)\\ \texttt{FunctionParameter}(f,i,x)\\ \texttt{CreatedBy}(arg,arg')\end{array}}{\texttt{CreatedBy}(x,arg')} \ \ (\text{CBY-9}) \qquad \frac{\begin{array}{c}\texttt{Call}(r,f)\\ \texttt{ReturnValue}(f,v)\\ \texttt{CreatedBy}(v,v')\end{array}}{\texttt{CreatedBy}(r,v')} \ \ (\text{CBY-10})$$

$$\frac{\begin{array}{c}\texttt{NodePattern}(v,tag,n)\\ \texttt{NodeParameter}(v,i,u)\\ \texttt{CreatedBy}(n,n')\\ \texttt{Node}(n',tag)\\ \texttt{NodeArgument}(n',i,arg)\\ \texttt{CreatedBy}(arg,arg')\end{array}}{\texttt{CreatedBy}(u,arg')} \ \ (\text{CBY-11}) \qquad \frac{\begin{array}{c}\texttt{NodePattern}(v,*,n)\\ \texttt{CreatedBy}(n,n')\end{array}}{\texttt{CreatedBy}(v,n')} \ \ (\text{CBY-12})$$

$$\frac{\texttt{Case}(r, scrut) \quad \texttt{AltLiteral}(r, alt, *) \quad \texttt{CreatedBy}(scrut, scrut')}{\texttt{CreatedBy}(alt, scrut')} \quad \text{(CB\textsc{y}-13)}$$

$$\frac{\texttt{Case}(r, scrut) \quad \texttt{AltLiteral}(r, alt, tag) \quad \texttt{CreatedBy}(scrut, scrut') \quad \texttt{Node}(scrut', tag)}{\texttt{CreatedBy}(alt, scrut')} \quad \text{(CB\textsc{y}-14)}$$

$$\frac{\texttt{Case}(r, scrut) \quad \texttt{AltDefault}(r, alt) \quad \texttt{CreatedBy}(scrut, scrut')}{\texttt{CreatedBy}(alt, scrut')} \quad \text{(CB\textsc{y}-15)}$$

$$\frac{\texttt{Case}(r, scrut) \quad \texttt{Alt}(r, *, tag) \quad \texttt{AltParameter}(r, tag, i, altParam) \quad \texttt{CreatedBy}(scrut, scrut') \quad \texttt{Node}(scrut', tag) \quad \texttt{NodeArgument}(scrut', i, nodeArg) \quad \texttt{CreatedBy}(nodeArg, nodeArg')}{\texttt{CreatedBy}(altParam, nodeArg')} \quad \text{(CB\textsc{y}-16)}$$

$$\frac{\texttt{Case}(r, scrut) \quad \texttt{Alt}(r, alt, tag) \quad \texttt{CreatedBy}(scrut, scrut') \quad \texttt{Node}(scrut', tag) \quad \texttt{ReturnValue}(alt, v) \quad \texttt{CreatedBy}(v, v')}{\texttt{CreatedBy}(r, v')} \quad \text{(CB\textsc{y}-17)}$$

$$\frac{\texttt{Case}(r, *) \quad \texttt{AltLiteral}(r, alt, *) \quad \texttt{ReturnValue}(alt, v) \quad \texttt{CreatedBy}(v, v')}{\texttt{CreatedBy}(r, v')} \quad \text{(CB\textsc{y}-18)}$$

$$\frac{\texttt{Case}(r, *) \quad \texttt{AltDefault}(r, alt) \quad \texttt{ReturnValue}(alt, v) \quad \texttt{CreatedBy}(v, v')}{\texttt{CreatedBy}(r, v')} \quad \text{(CB\textsc{y}-19)}$$

$$\frac{\texttt{Node}(n', t) \quad \texttt{CreatedBy}(v, v')}{\texttt{NodeCreatedBy}(n, t, n')} \quad \text{(NCB\textsc{y})}$$

$$\frac{\texttt{NodeCreatedBy}(n, t, *)}{\texttt{PossibleNodeTag}(n, t)} \quad \text{(PNT)}$$

$$\frac{\texttt{AltDefault}(*, alt)}{\texttt{PossibleAlt}(alt)} \quad \text{(PA-1)}$$

$$\frac{\texttt{AltLiteral}(*, alt, *)}{\texttt{PossibleAlt}(alt)} \quad \text{(PA-2)}$$

$$\frac{\texttt{Case}(r, scrut) \quad \texttt{Alt}(r, alt, t) \quad \texttt{NodeCreatedBy}(scrut, t, scrut')}{\texttt{PossibleAlt}(alt)} \quad \text{(PA-3)}$$

$$\frac{\texttt{Store}(q, *) \quad \texttt{CreatedBy}(p, q)}{\texttt{PointerOrigin}(p, q)} \quad \text{(PO)}$$

$$\frac{\texttt{Heap}(p, n) \quad \texttt{PossibleNodeTag}(n, tag)}{\texttt{PossibleLocTag}(p, t)} \quad \text{(PLT)}$$

$$\frac{\begin{array}{c} \texttt{EntryPoint}(main) \\ \texttt{ReturnValue}(main, x) \end{array}}{\texttt{LiveSVal}(x)} \ \text{(LS-1)} \qquad \frac{\begin{array}{c} \texttt{Call}(y, f) \\ \texttt{CallArgument}(y, *, x) \\ \texttt{External}(f, true, *) \end{array}}{\texttt{LiveSVal}(x)} \ \text{(LS-2)} \qquad \frac{\begin{array}{c} \texttt{LiveSVal}(y) \\ \texttt{Move}(y, x) \end{array}}{\texttt{LiveSVal}(x)} \ \text{(LS-3)}$$

$$\frac{\begin{array}{c} \texttt{LiveSVal}(res) \quad \texttt{PossibleAlt}(alt) \quad \texttt{ReturnValue}(alt, ret) \\ (\texttt{Alt}(res, alt, *) \vee \texttt{AltLiteral}(res, alt, *) \vee \texttt{AltDefault}(res, alt)) \end{array}}{\texttt{LiveSVal}(ret)} \ \text{(LS-4)}$$

$$\frac{\begin{array}{c} \texttt{LiveSVal}(alt) \quad \texttt{PossibleAlt}(alt) \quad \texttt{Case}(res, scrut) \\ (\texttt{Alt}(res, alt, *) \vee \texttt{AltLiteral}(res, alt, *) \vee \texttt{AltDefault}(res, alt)) \end{array}}{\texttt{LiveSVal}(scrut)} \ \text{(LS-5)}$$

$$\frac{\begin{array}{c} \texttt{LiveSVal}(y) \\ \texttt{Call}(y, f) \end{array}}{\texttt{LiveFunRetSimple}(f)} \ \text{(LFS-3)} \qquad \frac{\begin{array}{c} \texttt{LiveFunRetSimple}(f) \\ \texttt{ReturnValue}(f, ret) \end{array}}{\texttt{LiveSVal}(ret)} \ \text{(LS-6)}$$

$$\frac{\begin{array}{c} \texttt{LiveSVal}(param) \\ \texttt{FunctionParameter}(f, i, param) \\ \texttt{Call}(y, f) \\ \texttt{CallArgument}(y, i, x) \end{array}}{\texttt{LiveSVal}(x)} \ \text{(LS-7)} \qquad \frac{\begin{array}{c} \texttt{LiveFunRetSimple}(f_{ext}) \\ \texttt{External}(f_{ext}, *, *) \\ \texttt{Call}(y, f_{ext}) \\ \texttt{CallArgument}(y, *, x) \end{array}}{\texttt{LiveSVal}(x)} \ \text{(LS-8)}$$

$$\frac{\begin{array}{c} \texttt{LiveNodeArg}(n, t, i) \\ \texttt{Node}(n, t) \\ \texttt{NodeArgument}(n, i, x) \end{array}}{\texttt{LiveSVal}(x)} \ \text{(LS-9)}$$

$$\frac{\begin{array}{c}\texttt{LiveSVal}(x)\\\texttt{NodeParameter}(as,i,x)\\\texttt{NodePattern}(as,t,n)\end{array}}{\texttt{LiveNodeArg}(n,t,i)}\ \text{(LNA-1)}\qquad\frac{\begin{array}{c}\texttt{LiveNodeArg}(as,t,i)\\\texttt{NodePattern}(as,t,n)\end{array}}{\texttt{LiveNodeArg}(n,t,i)}\ \text{(LNA-2)}$$

$$\frac{\begin{array}{c}\texttt{LiveSVal}(()x)\\\texttt{NodePattern}(as,t,n)\\\texttt{NodeParameter}(as,i,x)\end{array}}{\texttt{LiveNodeArg}(n,t,i)}\ \text{(LNA-3)}\qquad\frac{\begin{array}{c}\texttt{LiveNodeArg}(n,t,i)\\\texttt{Move}(n,m)\end{array}}{\texttt{LiveNodeArg}(m,t,i)}\ \text{(LNA-4)}$$

$$\frac{\begin{array}{c}\texttt{LiveNodeArg}(alt,t,i)\\\texttt{Case}(r,scrut)\\\texttt{Alt}(r,alt,t)\\\texttt{AltParameter}(r,t,i,*)\end{array}}{\texttt{LiveNodeArg}(scrut,t,i)}\ \text{(LNA-5)}\qquad\frac{\begin{array}{c}\texttt{LiveSVal}(x)\\\texttt{Case}(r,scrut)\\\texttt{AltParameter}(r,t,i,x)\end{array}}{\texttt{LiveNodeArg}(scrut,t,i)}\ \text{(LNA-6)}$$

$$\frac{\begin{array}{c}\texttt{LiveNodeArg}(res,t_{res},i)\\\texttt{Case}(res,scrut)\\\texttt{Alt}(res,alt,t_{alt})\\\texttt{ReturnValue}(alt,ret)\\\texttt{PossibleAlt}(alt)\\\texttt{CreatedBy}(ret,ret')\\\texttt{Node}(ret',t_{res})\end{array}}{\texttt{LiveNodeArg}(ret,t_{res},i)}\ \text{(LNA-7)}$$

$$\frac{\begin{array}{c}\texttt{LiveNodeArg}(res,t_{res},i)\\\texttt{Case}(res,*)\\(\texttt{AltLiteral}(res,alt,*)\vee\texttt{AltDefault}(res,alt))\\\texttt{ReturnValue}(alt,ret)\\\texttt{CreatedBy}(ret,ret')\\\texttt{Node}(ret',t_{res})\end{array}}{\texttt{LiveNodeArg}(ret,t_{res},i)}\ \text{(LNA-8)}$$

$$\frac{\begin{array}{c}\texttt{LiveNodeArg}(y,t,i)\\\texttt{Call}(y,f)\end{array}}{\texttt{LiveFunRetNodeArg}(f,t,i)}\ \text{(LFN)}\qquad\frac{\begin{array}{c}\texttt{LiveFunRetNodeArg}(f,t,i)\\\texttt{ReturnValue}(f,r)\end{array}}{\texttt{LiveNodeArg}(r,t,i)}\ \text{(LNA-9)}$$

$$\frac{\begin{array}{c}\texttt{LiveNodeArg}(param,t,i)\\\texttt{FunctionParameter}(f,j,param)\\\texttt{Call}(y,f)\\\texttt{CallArgument}(y,j,x)\end{array}}{\texttt{LiveNodeArg}(x,t,i)}\ \text{(LNA-10)}\qquad\frac{\begin{array}{c}\texttt{LiveNodeArg}(n,t,i)\\\texttt{Fetch}(n,p)\\\texttt{PointerOrigin}(p,q)\\\texttt{PossibleLocTag}(q,t)\end{array}}{\texttt{LiveHeapNodeArg}(q,t,i)}\ \text{(LHN)}$$

$$\frac{\begin{array}{c}\texttt{LiveHeapNodeArg}(p,t,i)\\\texttt{Store}(q,n)\\\texttt{PointerOrigin}(p,q)\\\texttt{PossibleNodeTag}(n,t)\end{array}}{\texttt{LiveNodeArg}(n,t,i)}\ \text{(LNA-11)}\qquad\frac{\begin{array}{c}\texttt{LiveHeapNodeArg}(q,t,i)\\\texttt{Update}(*,p,n)\\\texttt{PointerOrigin}(p,q)\\\texttt{PossibleNodeTag}(n,t)\end{array}}{\texttt{LiveNodeArg}(n,t,i)}\ \text{(LNA-12)}$$